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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. LV
No. 1426

SATURDAY, OCTOBER 26, 1946
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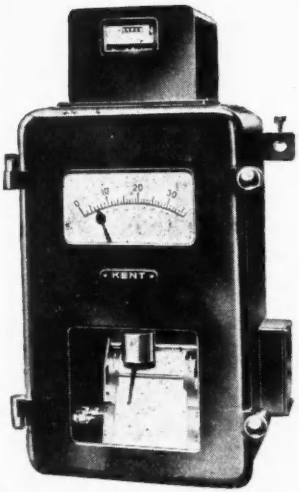

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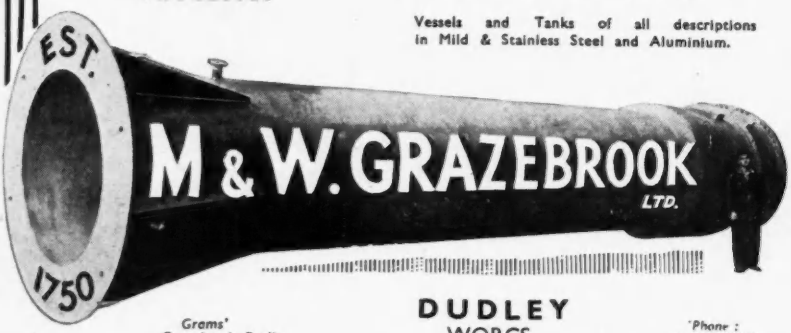

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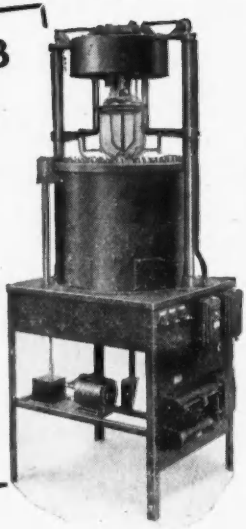

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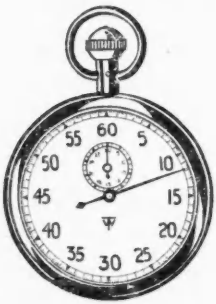

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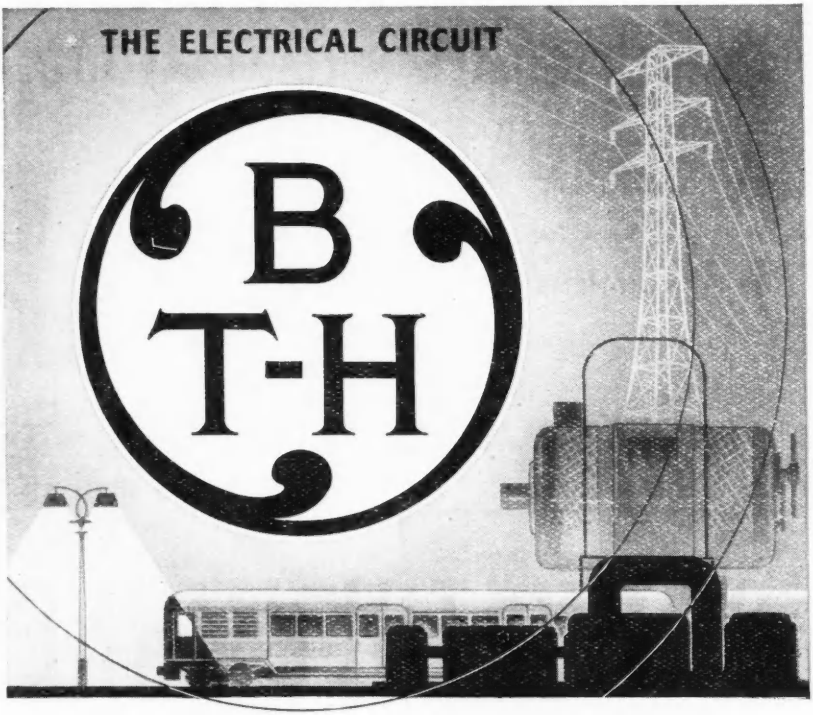

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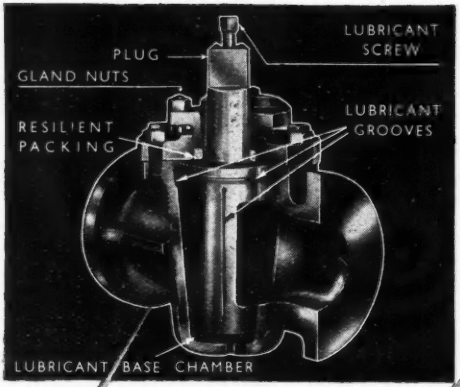

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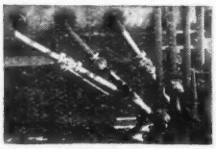

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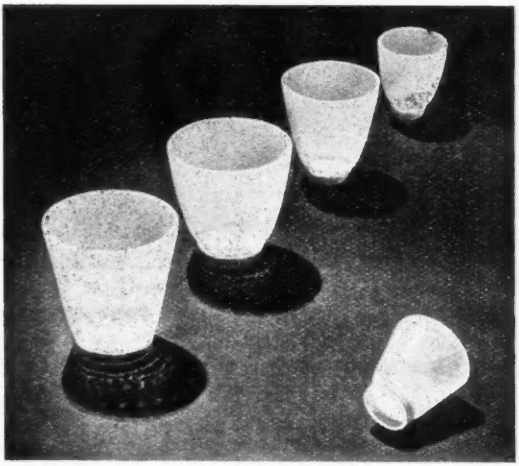

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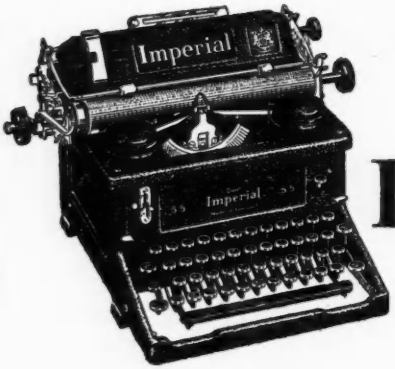

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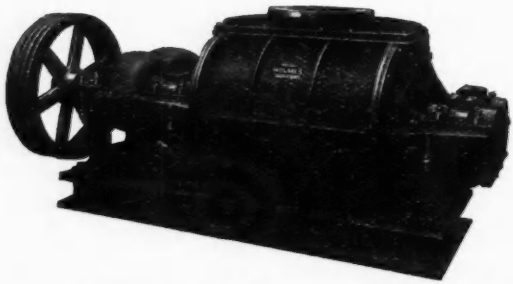

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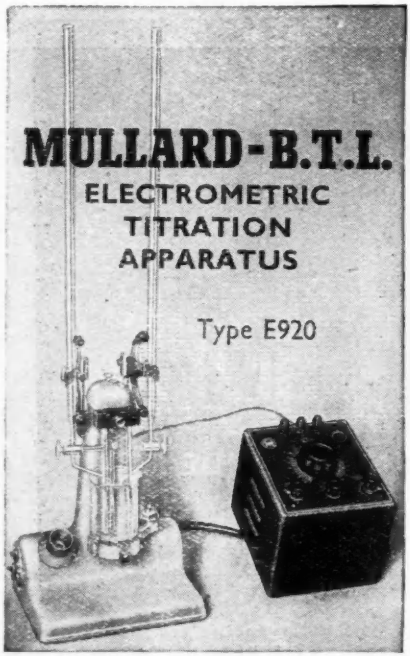

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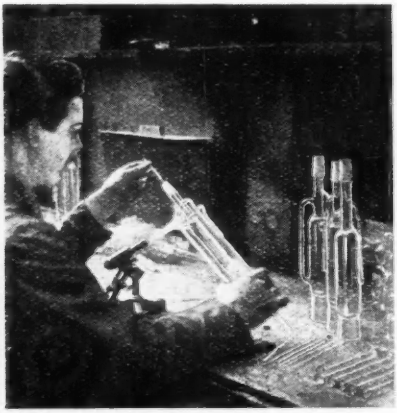

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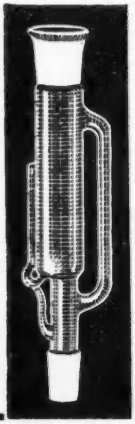

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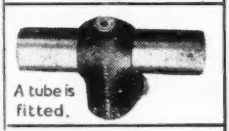

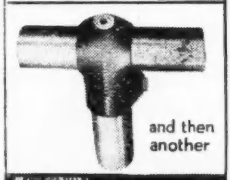

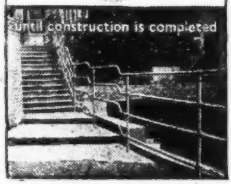

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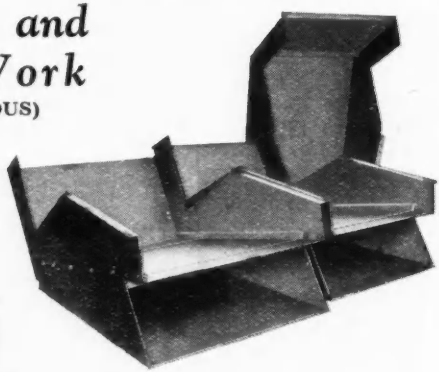

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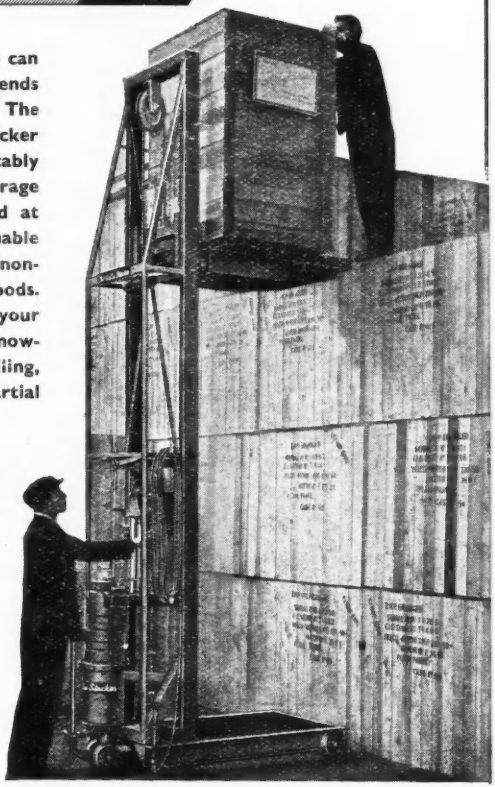

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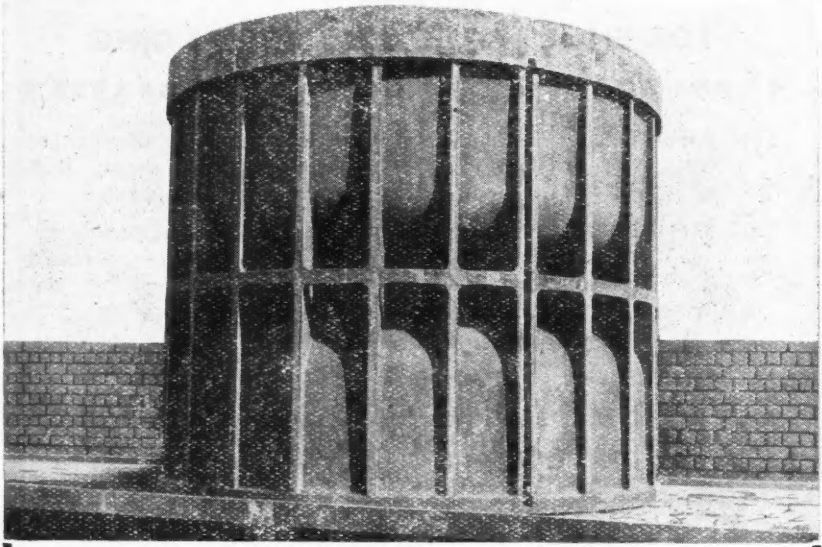

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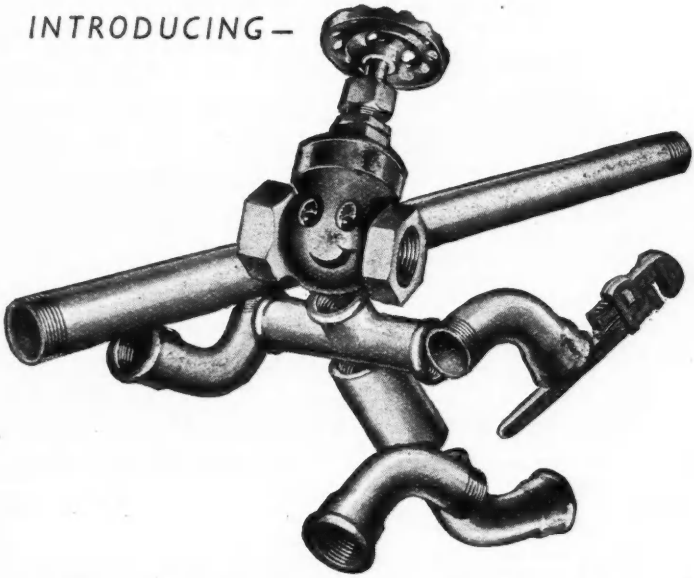

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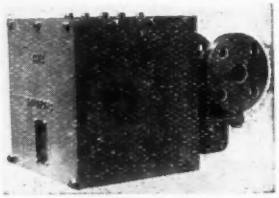

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Fuel and the Future

THE great conference on the efficient use of fuel has ended its deliberations, and it is desirable to attempt some summing-up of its conclusions. It was the most widely attended conference that has ever been held on the subject. It was addressed by two Cabinet Ministers, and other high Government and industrial authorities. It is difficult to think of any aspect of the subject of fuel utilisation that was not covered. One's regret was that the exigencies of time made it necessary to hold so many meetings simultaneously that the industrialist or technologist interested in more than one aspect of the subject had perforce to choose which session he would attend. Many fuel experts of high reputation addressed the sessional meetings. In a sense this conference, coming so soon after the grant of a Royal Charter to the Institute of Fuel, may be said to have put the seal upon fuel technology as one of the premier industrial professions of the country. Fuel is necessary in every industry, from agriculture to steel production, from mining to the manufacture of textiles. Without it, the industries of the country would soon cease to operate. Upon fuel depends the position of this country as a Great Power. It is wise that we should take thought how to use our greatest natural raw material to the best advantage.

The Conference disclosed what many had known for some time, namely, that the prospects of there being adequate fuel for the coming winter are not bright. It seems that it is impossible to expect much more coal from the pits. Whether the miners as a body are working to maximum capacity or not, is not for us to say; the fact that production per man-shift is less than it was before the war may be due to many reasons. Absenteeism is certainly one of these, and as we explained in our issue of October 12, one important reason for that is the shortage of consumer goods and the elimination of any incentive to work harder. Good management can secure greater output per man-shift from a reduced labour force and thus offset shortage of labour. Good management, however, involves giving the workers the tools with which to produce more — in short, mechanisation. The mines cannot be mechanised overnight, and this necessary technical step is likely to take many years. Plainly, therefore, as a short-term policy, the only certain answer to shortage of fuel is economy in its use.

How much coal must the country save? Here we profess to be

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in some doubt. Mr. Shinwell changes his tune more often than any other Minister, and he has left doubts in the public mind more than once this year as to the reality of the crisis that is now upon us. He has told us in Parliamentary speeches that we are 5,000,000 tons of coal short of our yearly requirements. He told the Conference that an additional 100,000 tons of coal a week would enable the nation to get through the winter without major dislocation. But Sir Stafford Cripps at the same Conference pointed to the need for greatly increasing our production of all goods, both for home consumption and for export. "We cannot do that," he said, "unless we increase our efficiency. To increase our efficiency of production means more mechanisation, and this in turn means more fuel and power." Thus the production drive is likely to demand further coal, over and above the present deficit of 5,000,000 tons. An example comes from agriculture. It was pointed out that grass-drying is a method by which our present deficiencies of feeding-stuffs for livestock can be made good, and the production of grass increased. It was further indicated that the fresh grass, dried immediately on cutting, provides material for the chemical industry in the form of certain chemicals, as well as chlorophyll and colouring matter. The grass-drying programme has had to be severely cut for lack of fuel.

We want more coal than the Minister of Fuel and Power suggested, if the full programme of production is to be put into effect. "If we suffer a hold-up this winter due to shortage of fuel and power," said Sir Stafford Cripps, "it will have the gravest effect on our export trade, and therefore on the supply of consumer goods now coming forward." Mr. Shinwell, in opening the Conference, asked for a general saving in home and industry alike of 10 per cent. That would mean about 15,000,000 to 20,000,000 tons of coal a year. In our view that seems about the proper target—and there is no reason why it should not be achieved without loss of production if proper measures are taken.

How can that be achieved? There is a short-term policy and a long-term policy. The short-term policy was set forth by Dr. E. S. Grumell, Chairman of the Fuel Efficiency Committee. First, the system of fuel watchers put into effect during the war should be immediately resuscitated and considerably extended. That system needs good organisation and the enlistment of the interest and co-operation of everyone in the country. The housewife at home, the worker and the manager in the factory, must all bear their share and with a will. That will take care of careless wastage and when allied to technical skill will rectify the more insidious defects which are equally wasteful of fuel. The second measure should be an all-out drive to secure maximum combustion efficiency in shell boiler plants and other combustion equipment. There are no doubt other measures which skilled engineers can suggest in the light of their local conditions. Chemical engineers in particular, will find that this is work for which they are peculiarly well fitted.

What of the long-term policy? There, we must confess, we found the Conference a disappointment. The "long-term" policy proposed by the Ministry seems to consist of little but opportunism. Although in his opening speech Mr. Shinwell announced that he would "turn from the short-term prospects to the long-term, from the period of improvisation to that of planning," his plans appear to consist of nothing more than the general encouragement of fuel efficiency in operation and in the design of plant. He pointed with satisfaction to the improvements in those directions that have been made in many industries during the past 20 or 30 years and called for a continuation of that process. Mr. Oliver Lyle, himself a member of the Fuel Efficiency Committee, has pointed out in his paper "Inefficiency" that by proper utilisation of our fuel, something like 80,000,000 tons of coal could be saved annually. A general electrificaton of the railways, for example, would save 10,000,000 tons; proper planning of power production another 21,000,000; collieries could save 5,500 000; the iron and steel industry 2,000,000; the proper use of domestic fuel based on carbonisation could save 23,000,000; and other industries well over 11,000,000 tons. These savings will be brought about only by the conscious planning of our fuel-using industries on a major scale. It is a great task; but the prize is glittering. It may be that Mr. Lyle's estimate is exaggerated; but if the attainable savings in coal are only half those amounts, and if in addition this country can be made smokeless—what a truly enormous benefit in reduced costs would be conferred on industry and on the whole nation!

NOTES AND COMMENTS

Trade and Government

ALTHOUGH it does not say so in so many words, the latest manifesto of the Federation of British Industries, concerning the relation between Trade and Government, is actually an indictment of the Working Parties established by the President of the Board of Trade to review the working of certain trades. It is pointed out that the Working Parties were appointed at a time when conditions were abnormal, and, while they may be eminently suited to such conditions, it by no means follows that they offer the best form of machinery for dealing with the future problems of industry, which, we all hope, will gradually approach more closely to the normal. Some organised contact between Government and industry there must be, however; and the F.B.I. contends that the obvious and most suitable contact can be provided by the Trade Associations. It is emphasised that the proposals embodied in the present recommendations should not be taken to refer to labour questions; but it is pointed out that all the Working Party reports so far issued agree that in any future arrangements the Trade Unions concerned must be associated with management in the consideration of general questions affecting the well-being of an industry. The counterpart of the Trade Union, on the management side, it is now contended, should be the Trade Association, which should take the lead in "improving and adjusting the organisation, both technical and commercial, of the sections of industry concerned, to meet the circumstances of the post-war world."

Methods of Co-operation

SOME commentators have seen in these proposals an extension of the "closed-shop" principle; but it is necessary to be on one's guard here, and not be carried away by the fascination of a topical catch-word. It does not appear to us that the present proposals will make it any more difficult than in the past for the non-member of a Trade Association to carry on his business—just as there are non-Union houses which have been able to survive in various industries, despite the growing influence of the Trade Unions. Nevertheless, these proposals do present a further inducement for the independent firm to join in with its Trade Association—a practice which, in our humble opinion, offers other advantages besides that of being able to negotiate on something like equal terms with a Government department. The F.B.I. document goes on to outline three main systems by which co-operation between Trade and Government might be effected: (a) direct contact; (b) an advisory council; and (c) a statutory industry board. The first has already been tried, and has worked well in many industries where mutual confidence is high, and we agree that there is no reason for change here.

Advisory Councils

WHEN, on the other hand, the Government feels that a wider source of information ought to be available, an advisory council might be appointed, partaking in some degree of the nature of the Working Parties, for instance in having an independent chairman—perhaps even the Minister himself, or a high official in his department—but differing from them in keeping within the bounds of the industry and the department concerned for its composition. The third alternative, the statutory industry board, should be employed only where internal differences make voluntary action impossible, or nearly so. Such bodies, we agree, should be created only in exceptional circumstances, and should never be forced on an unwilling industry, each board being the subject of a separate Bill in Parliament. The whole question is one which requires prolonged consideration, and whatever the final conclusion, the F.B.I. is to be thanked for bringing the question into the limelight.

Goodwill and Illwill

IN most business balance-sheets a goodwill entry will be found on the asset side. The real value of this is always the subject of doubt and discussion observes Sir Ernest Benn in an article in *Truth*, but the fact is that a precise value can seldom be placed upon the goodwill of a business. This serves to differentiate goodwill from every other type of asset and to emphasise its importance. Goodwill may be defined as the prospect of continuity, it is the measure of the satisfaction that may be expected to bring the customers back for more. The preservation of his goodwill is then the overriding

anxiety with every good business man, who always thinks less of the profit and benefit of the orders in hand than of the continuing profit to be expected if those orders are filled in such a way as to give the maximum of satisfaction to the customer. To-day some thousands of millions of trade is done by the Government. Not a pennyworth of goodwill attaches to a single sovereign's worth of it. Indeed, on the contrary, most of it produces a great deal of illwill in the minds of all the parties concerned. Bulk purchasing, like the black-out, was imposed on us by Hitler, but while we have been able to shake off the horrors of the latter, the blacking or blotting out of the natural commercial structure by bulk official sale and purchase has been continued and indeed intensified. The willing buyer and the willing seller, in the sense in which those terms were previously used, are now almost non-existent; nobody, whether in trade or in any other way, deals willingly with any government, for government by its nature is force.

Transactions by Force

WHEN one government buys from another government force is applied at both ends of the transaction; the seller government enforces its own terms upon its own producer and the buyer government imposes its own terms upon its own consumers. All the elements of prosperity and progress are absent from these synthetic transactions. Price is a political calculation having little, if anything, to do with reality, as for instance when an egg is bought for 3½d., sold for 2½d., and another 1d. spent on the doing of it. A genuine market price, indicating with accurate certainty the relative state of effective demand and available supply, is almost a thing of the past. Commodities are commandeered, and rationed at different figures in every market, commandeering having taken the place of buying, and rationing being the present-day substitute for selling. In the result, the Canadian farmer is labouring under a sense of grievance, New Zealand is disgruntled because we pay more elsewhere, Argentina goes on strike at our terms, and the French prohibit the delivery of produce which would flow to us at a natural market quotation. In every country and in many trades minimum wages and maximum prices, both prescribed for political reasons, fail to fit, are liable to arbitrary alteration, and discourage or destroy both enterprise and employment.

The New Utilitarianism

QUALITY has ceased to be of the importance once attaching to it, and here is perhaps the most serious count in the indictment of government trading. Nothing is as good as it was. Coal, cheese, butter, bacon, mineral water, are the elementary samples of the new utilitarianism which is rapidly robbing most of the amenities of their appetising attributes. The humblest of housewives, who used to choose a chop to suit the taste of her man, is now reduced to 1s. 2d. worth of unclassified "meat," and everything is in like case, for goodwill and quality are close relations. Some of these descents from decency are due to scarcity, but others are directly due to the replacement of the tradesman by the official. Instead of Freedom from Fear as promised by the Atlantic Charter, deep-rooted fear is now the prevailing sentiment in the breasts of all those on whom the economic well-being of mankind has hitherto depended. And that fear is best defined in the language of commerce as the absence of goodwill. Sir Ernest assures his readers that the present aim is to establish Government trading on a permanent basis. Along that way, he says, lies disaster; recovery will only occur in so far as this policy is reversed and genuine markets opened.

Zinc Phosphide

Poisons Act Amendments

AMENDMENTS to the Poisons List and Poisons Rules (Pharmacy and Poisons Act, 1933), coming into effect on October 15 (S. R. & O. 1946, Nos. 1625, 1626), are as follows: to Part I of the Poisons List are added dihydrodesoxymorphine, and pethidine and its salts; and to Part II of the List is added zinc phosphide.

In the Poisons Rules, dihydrodesoxymorphine, pethidine and its salts, and zinc phosphide are added to the First Schedule; but "articles containing zinc phosphide and prepared for the destruction of rats and mice" are exempted from First Schedule requirements by an amendment to Rule 10. Zinc phosphide is also included in the Fifth Schedule with an entry which permits listed sellers of Part II poisons to sell the poison *only* in the form of preparations for the destruction of rodents.

Phenols from Ammoniacal Liquor

Description of Plant for their Removal

A PAPER entitled "The Removal of Phenols from Gas Works Ammoniacal Liquor," by D. G. Murdoch, B.Sc., A.R.I.C., A.C.G.F.C., A.M.I.Chem.E., and M. Cuckney, B.Sc., A.R.I.C., was read by Mr. Murdoch at a meeting of the Institution of Chemical Engineers at Burlington House, Piccadilly, London, W.1, on October 8.

The paper included a description of a full-scale plant, as follows: Gas liquor, after settling and separating from tar in three storage wells (total capacity 1,000,000 gal.), is pumped therefrom by an electrically-driven, horizontal reciprocating pump through a 9-in. C.I. main to the dephenolation plant. Each pump is capable of delivering 20,000 gal. gas liquor per hour at a pressure of 25 lb./sq. in.

The gas liquor passes to four tubular preheaters in series, where its temperature is raised to 20-25° C. by means of low-pressure exhaust steam. Experience has shown that this temperature is desirable to obtain good separation of wash oil and gas liquor; the use of higher temperatures induces loss of wash oil by increased solubility in the gas liquor. The condensed steam from the jackets passes through a seal pipe to a 500 gal. storage tank on the ground floor, and serves as a water supply for No. 1 stage, as well as for the preparation of fresh caustic soda liquor if this is required. The preheated gas liquor passes through two tar separators charged with coke nuts (shown in Fig. 1), on which any tarry particles are deposited, thence *via* a twin strainer to an overhead balance tank. Provision has been made for by-passing the preheaters and tar separators, as well as the dephenolation plant, if necessary.

Turbidity Detector

A selenium cell for the detection of turbid or tarry gas liquor is located on the inlet gas liquor main just before the preheaters. A gentle stream of gas liquor passes through a glass-sided container, which is illuminated by a 100-watt lamp suitably housed. The turbidity of the liquor affects the amount of light passing through the liquor on to the selenium cell, and causes a red warning lamp on the control panel to light up when the gas liquor is turbid. A similar unit has been fixed on the washed gas liquor stream leaving the plant to detect suspended oil particles if the separation is not satisfactory.

The tar separators consist of two mild steel cylindrical vessels, of 6 ft. 6 in. dia. and 17 ft. 3 in. over-all height, each with conical bottom and domed cover provided with safety valve, pressure gauge and vent pipe; the normal working pressure is 15-25 lb. per sq. in. Each separator is charged with 4 tons 2-in. to 3-in. furnace coke to fill the lower 7 ft. 6 in. depth, and 3 tons of 1-in. to 2-in. coke to fill the upper 5 ft. The coke rests on a perforated metal grid. The gas liquor enters near the bottom, passes up through the coke layer, and leaves near the top. Tarry material deposited on the surface of the coke gradually falls to the conical base, and is run off periodically. When the coke becomes fouled with tar, provision is made to by-pass each separator. The gas liquor is run out to the well, and open steam is then passed into the base of the separator to warm the coke and facilitate the removal from its surface of adhering tar, which collects at the base and is run off to storage. Finally, the steam is shut off, and, after a period of cooling, the separator is recharged with gas liquor and put into the circuit again.

Removable Filters

A twin strainer is situated at the outlet of No. 2 tar separator, and contains two perforated metal filters, which are removable for cleaning. The gas liquor flow can be diverted by means of valves so that one of the filters can be removed without stopping the flow through the other. The filter traps any small pieces of coke carrier forward in the gas liquor leaving the tar separators. The gas liquor, now preheated to 20-25° C., and substantially free from tarry matter, passes to a mild steel overhead balance tank of 1060 gal. capacity, provided with a 6-in. ball valve on the inlet this valve has a stainless steel seating. From here the gas liquor flows by gravity at constant head to the washers, entering at No. 10 mixer.

The washing plant consists of the following ten pairs of mixers and corresponding separators: No. 1 stage, charged wash oil and water; Nos. 2, 3 and 4 stages, wash oil and revived soda; Nos. 5-9 stages, gas liquor and wash oil; No. 10 stage, gas liquor detarring by oil in closed circuit.

The mixers are cast-iron cylindrical vessels, each of 800-gal. capacity, 4 ft. 3 in. internal diameter by 8 ft. deep by 1⅛ in. thick. There are flanged branches of 14-in., 12-in., 9-in., and 6-in. bore on each mixer, and a 2-in. bottom outlet. Each cover (1¼ in. thick) has a 6-in. diameter dip hole and cover with gas seal, and an 18-in. hole to receive the agitator steady bracket and bearing. The agitator in each mixer consists of a steel vertical shaft, 2½ in. diameter, offset 9 in. from centre of vessel, fitted with ⅜-in. thick diamond-shaped agitator blades, welded to the shaft, surmounted by

a 12-in. diameter by ¼-in. thick anti-vortex disc immediately above the top blade. The shaft extends 5 ft. 6 in. above the top of mixer, and is supported by a C.I. steady bracket with ball thrust and ball bearing. The shaft has a lower ball bearing carried between two sections of the steady bracket about 18 in. above the top of the mixer, and is fitted with a cup form of gas seal placed on top of the cover. The gearing consists of a C.I. machine-cut bevel wheel and a "Fabroil" bevel pinion—ratio 2 : 1, with hunting tooth. The agitator driving shaft, 3 in. diameter, is carried in roller-bearing plummer blocks mounted upon stools welded to the tops of the separators, and is disposed centrally between the two rows of mixers; it is driven by V belt from a 20-h.p. motor. All the bearings are lubricated by the "Tecalemit" pressure system. All valves between the mixers and the separators regulating the flow are of iron, double flanged.

The separators are ten ⅜-in. mild steel vessels, Nos. 1-4 being 8 ft. 6 in. diameter by 18 ft. long, with flat ends, and 8000 gal. capacity, and Nos. 5-10, 9 ft. diameter by 18 ft. long, and 9000 gal. capacity. Each vessel is fitted with an 18-in. raised manhole with cover, gauge glass, and the necessary 14-in., 12-in., and 9-in. flanged connections. The separators and mixers are supported on a mild steel structure at approximately 9 ft. 3 in. above ground, and a gangway with grill flooring is fitted around the rectangle enclosing the tanks at 13 ft. 6 in. above ground level.

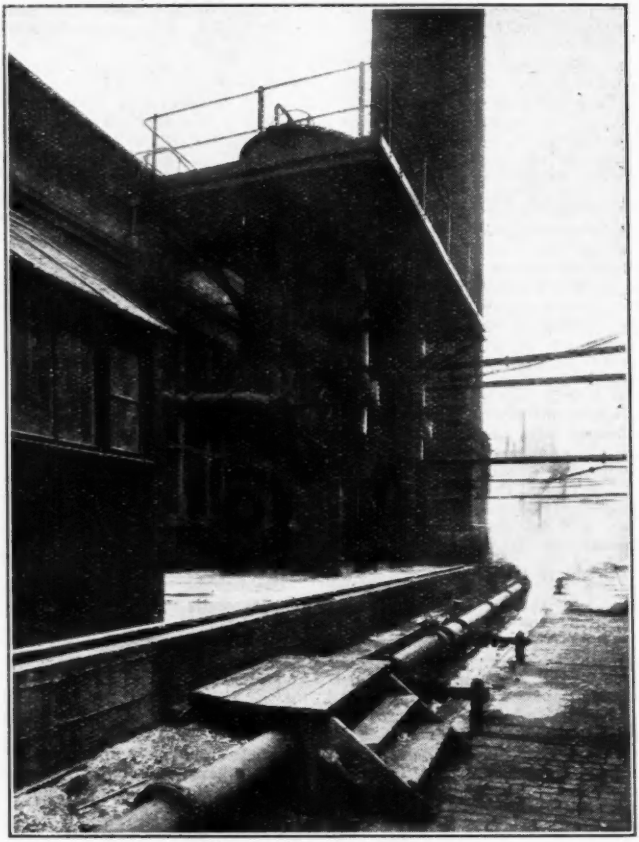

Fig. 1. Tar separators.

All the separators, except Nos. 2-4 in the

caustic soda wash oil section, are provided with skimming gear to separate any intermediate layer that forms at the interface between the gas liquor and wash oil layers. This consists of two slotted pipes mounted on hollow vertical spindles, capable of rotation horizontally inside the separator, and provided with means of being raised or lowered a total distance of 1 ft. The intermediate layer is run off slowly to a storage tank while the arms are being rotated, and this operation can be carried out without stopping the normal dephenolation process. The separated sludge is allowed to separate in the storage tank into an upper oil layer and a lower gas liquor layer, which are returned to the process. As the dephenolation plant has been run at a very uniform temperature of 20-25°C., with exclusion of air as much as possible, the amount of intermediate layer formed has not been so much as was anticipated from the experimental plant performance.

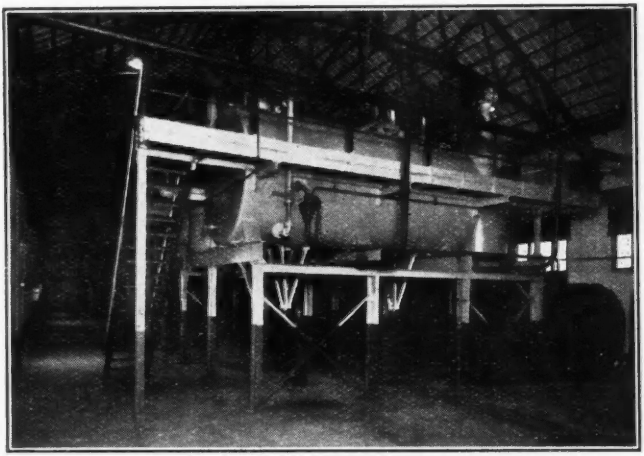

Fig. 2. General view of the plant, showing the skimming gear.

The gas liquor enters at the bottom of No. 10 mixer, where it is washed with a suitable oil in closed circuit to remove any traces of tar passing through the coke filters before it enters Nos. 9-5 sections, where it is dephenolated by counter-current washing with wash oil. The washed gas liquor passes out from No. 5 separator through an adjustable weir to a storage vessel of 9000 gal. capacity, from which it is pumped to the sulphate of ammonia plant. Wash oil, leaving No. 9 separator and charged with phenols extracted from the gas liquor, passes through a weir to a storage vessel of 5000 gal. capacity, from which it is pumped through a preheater to an overhead balance tank of 580 gallons capacity fitted with a 3-in. ball-valve. The wash oil flows by gravity to No. 1 mixer, where it is washed with 1 per cent. by volume of water to remove ammonia, H_2S, etc., and then passes Nos. 2-3 sections, where it is treated with revived soda and is finally washed substantially free from phenols in No. 4 section by a further quantity of revived soda, or, if necessary, with fresh soda liquor prepared from solid caustic soda and condensed steam. The wash oil containing not more than 0.05 per cent. phenols passes *via* a box weir to Nos. 5-9 sections, where it serves to extract the phenols from further batches of gas liquor, and overflows from the weir on No. 9 separator to the wash oil storage vessel.

Revived caustic soda is received from the causticising plant and collects in a storage vessel (8000 gal. capacity), from which it is elevated to a balance tank of 225 gal. capacity and flows by gravity to No. 4 mixer. The soda liquor becomes charged with phenols during the passage through Nos. 4, 3, and 2 sections in contact with the used wash oil, and the sodium carbonate liquor produced, containing 10 per cent. by volume of phenols, overflows from No. 2 separator through an adjustable weir to the storage vessel. From here it is pumped to the crude carbolic plant for the isolation of the crude phenols by carbonisation, and the sodium carbonate liquor produced is causticised with lime to regenerate revived soda liquor which is returned for use in the dephenolation plant.

Fresh caustic soda liquor is prepared when required by dissolving caustic soda direct from drums by sprays of water. The drum of caustic soda is hoisted up and placed in position on rollers in a chamber above the dissolving tank. A hole in the side of the drum, about 9 in. square, is cut

with chisel and hammer. This exposed portion of the soda is placed above the sprays, the cover of the chamber is closed, and water or dilute soda liquor is circulated by a pump and the spray regulated to impinge on the soda in the drum. As the caustic soda dissolves, the spray is increased to reach the remainder of the contents of the drum. One drum (750 lb.) of caustic soda is dissolved in about four hours, and yields 1340 gal. of 5 per cent. solution.

If the supply of revived soda from the carbolic plant is for any reason inadequate, fresh soda liquor is elevated to an overhead tank of 500-gal. capacity, and flows by gravity to No. 4 mixer for final washing of the wash oil, passes into No. 4 separator and joins the revived soda liquor delivered to No. 3 mixer. Water from an overhead tank of 500-gal. capacity flows by gravity to No. 1 mixer, where it serves to remove ammonia and H_2S from charged wash oil, and the aqueous extract overflows from No. 1 separator through a weir to the gas liquor well.

By adjustment of the height of the outlet weirs and the regulation of the valves on the circulation pipes between each mixer and its corresponding separator, the proportion of wash oil and gas liquor or soda liquor in each mixer may be kept at the desired ratio. On a central control panel are mounted the Kent's meters that record the rates of flow of the various liquors and wash oil flowing by gravity from the overhead balance tanks to the washers. Those for gas liquor and wash oil are of the recording and integrating type.

A flow indicator is provided to give the rate at which the dephenolated liquor is being pumped to the sulphate plant, and a Duplex flow controller enables the inlet gas liquor rate to the washers to be controlled automatically by the rate of washed gas liquor being pumped away, by means of electrical contacts which operate a motorised valve on the inlet gas liquor pipe to the washers. The temperatures of gas liquor and wash oil are registered on a Cambridge recorder, and a six-point indicator is provided to give the temperatures at various points in the washing process.

Recruitment for Foundries

Industry Needs 20,000 Men

A RECRUITING campaign to enlist 20,000 workers for British iron foundries is to be opened on November 1, announced Mr. William Leonard, Joint Parliamentary Secretary to the Ministry of Supply, during a visit to a foundry at Bolton, Lancs. The campaign will be run by the Ministry of Supply in co-operation with the Ministry of Labour and the Central Office of Information, and will be concentrated at first on obtaining 10,000 men for light castings for the housing programme. Unskilled workers between the ages of 16 and 45 are mainly needed. Methods to be used to get these men will be by booklets, films, broadcasts, posters and displays, and loudspeaker vans.

The shortage of labour in iron foundries is one of the bottlenecks restricting national production. Output to-day is 800,000 tons less than the pre-war figure of 3,300,000 tons.

Stud Welding

New Method Avoids Drilling

THE Nelson Electric Arc Stud Welding process, which is to be sponsored in this country by Cooke & Ferguson, Ltd., of Manchester, is a means of welding studs automatically and directly on to metal surfaces with complete fusion, without the necessity for drilling, tapping, or hand welding.

In use, the operator loads the stud in the appropriate chuck, and slips a ferrule, which is gripped by steel fingers, over the stud. The pointed end of the stud is positioned on the parent metal surface, and pressure is maintained against a spring which is loaded into the hand-tool, until the ferrule bears against the surface of the plate. On pressing the trigger button, the weld cycle takes place. No welding experience is necessary as the cycle is completely automatic after the control timing device has been set for the appropriate diameter of stud.

When the stud makes contact with base metal, a current flows through the complete circuit and is indicated visually by a small neon tube on the tool. The small current thus indicated is sufficient to burn through a layer of paint, red-lead, rust, or light scale.

The studs incorporate a patented method of loading which guarantees a sufficient amount of flux in each stud. This flux cannot be chipped off by handling previous to welding; it also allows more flux to be used than can be deposited by any other method. No separate a.c. supply for the control box is necessary. All relays, etc., work from the welding generator d.c. output.

The U.S. Department of Commerce recently set up an Office of Technical Services (O.T.S.) with the following five divisions: Inventions and Engineering; Industrial Research and Development; Technical Advisory Service; Bibliographic and Reference; Technical Industrial Intelligence.

Fuel Economy in Chemical Works*

Its Relation to Other Factors in Design

by B. E. A. VIGERS†

A HUNDRED years ago when this country was the leader of industrial development, it probably owed that position to three major assets. First, the enterprise and inventiveness of its industrial adventurers, second, the capacity of its artisan population for hard work and the acquirement of manual skill, and third, the possession of easily worked seams of high-quality coal. At that period there were also significant home reserves of other raw materials such as iron, tin, and lead ores, as well as agricultural products such as wool and timber. As time went on and industry developed, the indigenous supplies of these secondary materials became inadequate, but the enterprises which were established by British people overseas and the exports of services and manufactured products made possible the importation of all the many raw materials which were required for the continued maintenance and development of a great industrial population on an island, itself too small to provide even the food which that population required.

Reduced Assets

The changes brought about since 1914 have largely stripped the country of those assets which ensured the ability to purchase requirements from abroad, and the problem which has to be solved is that of the need to rebuild purchasing power in face of competition from many countries, which not only have their own supplies of raw materials, but which have themselves become highly industrialised and in many cases have sources of cheap power which are denied to this country.

The chemical industry, being largely concerned with the conversion of the products of nature to the raw materials of other industries, is acutely concerned in this situation, and to those who are employed in the design and operation of chemical works falls the duty of scheming to economise in those resources which are in short supply and costly, by making the maximum use of those which are cheaper and more readily available. In order to do this successfully, it is necessary to consider again, in the light of present circumstances, to what extent the three major assets are still available.

It is evident that coal is becoming scarcer, dearer, and of poorer quality. With an ageing population and shorter working hours, labour is becoming scarcer, and with the cyclic process of wage increases, it is becoming ever dearer.

Cheaper Technical Skill

Technical and management skill is the only commodity which is becoming relatively cheaper, since salaries do not rise in the same proportion as wages and prices. Unfortunately, just at a time when there is the greatest need for the technical ability and experience of the younger people, many of them have had their training interrupted by the war, and there is therefore a shortage in this respect also. On the credit side may be reckoned the experience of organising and dealing with their fellow men which many have gained in the Services. It is now doubly important that those who remained in industry should apply themselves to helping those others who are returning to it, to make the biggest contribution of which they are capable. It is only by great improvements in technique and management that there is any hope of making good the deficiencies in other directions.

A paper on the design of chemical works cannot ignore the fact that its subject involves a complex function of interrelated variables of which fuel economy is only one, and one which cannot be properly studied unless in relation to the others. The main factors which should be considered may be listed as follows:

(a) The requirements and limitations of the process which is to be operated.

(b) The economy of energy in all its forms.

(c) The economy of water for cooling and process purposes.

(d) Economy in handling materials.

(e) The economy of labour, skilled and unskilled.

(f) The economy of capital, management and supervision.

The central thesis of this paper is to emphasise that in the design of works, unless due consideration and weight is given to all these factors from the outset, the greatest over-all economy will not be achieved. In too many cases, the lay-out of a factory is determined on purely process considerations alone, the other points being regarded as services only, to be fitted in as well as may be, at a later date. It is sometimes said that because the business of a company is the manufacture of certain products in which

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the services do not appear as a major item of cost, these services should be kept as simple as possible instead of striving after the highest economy; but although simplicity is always attractive, it can be misleading. The intention is not to belittle simplicity as such: if two solutions of a problem achieve the desired end, equally successfully in all respects, then the simpler solution is the better, but the aim of this paper is rather to invite further consideration from those responsible for the design of the works who, for example, prefer to instal low-pressure boiler plant for process steam, and to buy all their power from the supply authorities on the grounds that any economy attained by combined generation is not worth the extra complication and maintenance involved. Such a view may be correct in some few instances, but it should not be so in general if enough attention is given to design, and if care is taken to conform to the principles dealt with in this paper.

In view of the foreseeable prospects facing the industries of this country, it is maintained that if the savings of a fuel economy scheme, such as that of the combined generation of heat and power, can be reliably shown to cover all its costs, howsoever arising, even though with little profit to the undertaking concerned, it should be adopted as a matter of national duty in order to save the coal which would otherwise have been consumed at the power supply authorities' generating station. The engineer and management should be prepared to accept the extra responsibility which may be involved as a contribution to national economy and an aid to the continued operation of industry.

Mutual Benefit

By the same token, an undertaking which does make such a contribution is surely entitled to consideration from the authorities who are responsible for the allocation of fuel. In the example quoted there will be a saving of an amount of fuel at the supply authorities' power station, but a fraction of this amount will be required to be burnt under the boilers of the factory in addition to that which would be required for low-pressure heating steam alone. This fact should be recognised, and the fuel should be made available. The power supply authority should also play its part and be more ready than is often the case to allow paralleling of factory generating plants on their mains, if the necessary protective gear is provided.

Chemical works vary so widely in their requirements that it is quite impossible in this paper to cover individual cases. Moreover, most managements have to deal with works which have grown up over a period of years, often resulting in the boiler house being remote from the centre of gravity of the load. In such cases, there may be long distances for the conveyance of low-pressure steam, and for the return of condensate. Material-handling problems may be so scattered that it is difficult to devise economical methods of dealing with them. It is therefore proposed to consider the interrelation of the various factors in the design of new works only, but with the hope that some of the points raised may also prove fruitful in the modernisation of old works.

Balance of Factors

It is not to be expected that the requirements of all the factors can be met to perfection. Some will have to be sacrificed in some measure in the interests of the others, but as has been said before, the best all-round result can only be attained if all are given consideration from the outset. Each will be dealt with in turn, and attention will be drawn to the points at which each impinges on the others.

If the principle is accepted that the designer of a process works is in duty bound to try to achieve the greatest possible economy in fuel, he must, at all times, pay close attention to the thermodynamic criterion that, whenever energy must be degraded, the maximum benefit resulting from the process must be striven for. Heat should be taken into the process at the highest practicable temperature; thereafter, it should be used with progressively falling temperatures with the minimum of irreversible processes, and should finally be rejected at as low a temperature as may be.

A very common breach of this rule is the use of direct firing for drying processes, which could equally well be effected by means of low-grade heat, either in the form of waste gases from furnaces which have to be operated at high temperature, or more commonly by exhaust steam from engines. In both of the latter cases, the heat which is produced at high temperature by burning fuel is first used to peform a useful function before passing on, with little loss of capacity, to evaporate moisture in the dryer.

In processes which involve high-temperature furnacing operations, the temperature required by the latter will usually dictate the conditions of the first use of the heat. It should be universally accepted that, wherever possible, the waste heat from such furnaces should be recovered in regenerators or recuperators, and the waste gases then passed to waste heat boilers or other means of heat recovery.

Electrical furnacing operations are a special case, in that the power supply, if obtained from thermal stations, has already passed through the process of conversion from heat to power. Except in such cases as the reduction of alumina to aluminium, where electric energy is used electrolytically as well as in the production of heat, or the

case of operations at extremely high temperatures, which could not be easily attained by other means, the use of such high-grade energy as electric power for heating should be justified only by very special process conditions or by exceptional economy of some other commodity such as labour or capital.

Steam Heat

In most processes where the major part of the heat required is not employed in high-temperature furnaces, the usual method of application of heat is by means of steam. Applying the thermodynamic criterion, the steam should be generated at the highest practicable pressure and temperature. It should be first used for the generation of power in steam engines or turbines and exhausted at the lowest permissible temperature and pressure for process uses. The practical limit for the inlet temperature and pressure will be determined by the considerations of the size of plant involved and of capital, labour and management. Small engines and turbines are not available for very high pressure, owing to clearance losses, etc. A higher grade of management and operative labour is required for the successful operation of high-pressure plant, and, while justified for a large output, the extra cost of such supervision would nullify the gain on a smaller installation. Questions of the quality of water available as boiler feed, and the amount of condensate which could be returned to the boilers also have a bearing on this subject.

High-pressure plant is, of course, more costly than low-pressure equipment of the same capacity, and if it is considered that availability is adversely affected, more provision must be made for stand-by, since over-all reliability in maintenance of output is usually of prime importance. For these reasons, high pressure usually involves high capital charges, but so long as all the foregoing factors are carefully assessed, the aim of the designer should be to adopt conditions for the maximum generation of power.

It is not easy to determine the lowest pressure at which the steam can be exhausted. The stated requirements for process use should be subjected to close scrutiny. In a great number of cases, such figures are based on heat-transfer requirements, and an examination should be made into the possibility of reducing the required temperature and pressure by increase of the area of heat-transfer surfaces.

In chemical processes advance in this direction is sometimes restrained by the need for special and costly corrosion-resisting materials in the construction of such surfaces. The point is, however, so important that investigation should be made of the possibility of modifying the process to remove the difficulty. For example, film coefficient may be improved by reducing the viscosity of a liquor or by increasing its velocity; or again, it may be possible to avoid a difficult evaporation of an acid liquor by carrying out the necessary concentration at another stage of the process where the liquor is neutral. An alternative method of attack may be to supply the major portion of the heat required in a process by means of low-pressure steam, and thereafter to use a small quantity at a higher pressure in order to attain the final temperature which is required. Such methods of "stage heating" are good examples of the thermodynamic approach to heat economy problems, and the regenerative feed heating methods which are adopted in high-efficiency power stations would repay study by those who are not familiar with them.

Apart from the limitations of process requirements, the capital cost and heat loss from large mains may be a deciding factor, and this is one of the most important aspects from which the lay-out of the works should be considered in relation to fuel economy. A difficult case is that in which, while a majority of the factory requirements can be met at a low pressure, a certain amount of steam must be supplied at an intermediate pressure. In such cases, it is necessary to consider whether it is most economical (a) to raise the back pressure of the whole steam output to meet the higher requirements, (b) to degrade the necessary quantity of high-pressure steam to the intermediate pressure without recovery of power, or (c) to employ a pass-out machine to provide the necessary intermediate supply. The correct solution can be determined only by detailed investigation of the over-all economics of each method.

Loss through Evaporation

While the principal gain accruing to the use of process steam at a low pressure is that more power may be generated per lb. of steam used, there is an additional reason for keeping the pressure as low as possible. When the condensate is drained through traps from any appliance operating at above atmospheric pressure, the sensible heat above 100°C. will cause a proportion of the condensate to evaporate as flash steam, and this, if allowed to escape to atmosphere, represents an important loss. If the working pressure is low, this loss is minimised and the need for complicated arrangements for its recovery may be avoided. If, however, the pressure must be high, it is most important that steps should be taken for such recovery, usually by allowing the condensate to flash in one or more stages into appropriate lower-pressure users. If such an arrangement must be adopted, it will be facilitated if early consideration has been given to the lay-out of the plant so that

successive users of the steam are conveniently adjacent to one another.

The grouping of plant in a factory in such a way that heat exhausted from one process either as steam or waste gases may be passed on efficiently to other users is a similar problem to that of handling materials through the factory, but it is often lost sight of. The ideal arrangement is that the boiler house should be at the centre of gravity of the load. The engine house will normally be built alongside the boiler house, and it is desirable that big users of low-pressure steam should be situated near by in order to reduce the captal cost and heat losses of the low-pressure mains. Users which must be supplied with high-pressure steam may be situated at a greater distance, since the steam mains for the conveyance of a given quantity of steam at high pressure will be smaller than those required for low pressure, and pressure drop in the high-pressure mains is less important. Exhaust steam from the high-pressure users should be discharged to an efficient flash system and returned *via* intermediate or low-pressure users towards the boiler house.

It is sometimes said that pressure drop in steam mains is of little importance since in itself it causes no loss of heat, and little fall in temperature. To take such a view is to sin against the second law, since the loss of pressure implies an increase of entropy and it is evident that anyone who maintains this view is thinking only in terms of the economy of heat and is taking no account of energy potential. The loss would be evident if all endeavours were beng made to achieve the lowest possible back-pressure on a steam engine or turbine. If no engine is installed, schemes ought to be in hand to put one in.

Economic Continuous Process

Heavy peak loads are among the most serious offenders against economy whether it be for steam, power, or even water. As against an equivalent steady load, capital is increased by the need for bigger boilers, engines, mains, valves, switchgear, etc. Peak loads upset the efficient working of boilers and engines, and usually additional labour and more careful management is required if waste is to be avoided. For these reasons, there is general preference for continuous rather than batch processes if equally good results in every respect can be attained.

It is sometimes possible, with great advantage, to convert existing batch processes to continuous operation. For example, large batch evaporators may cause very heavy peaks, particularly if started up on cold liquor; but it is often possible to change over to continuous working even with corrosive or crystallising liquors by suitable arrangement of feed and extraction pumps, and good control of steam and temperature, which may be automatic. If batch working cannot be avoided, the aim should be to take the maximum advantage of diversity by arranging that no two user units go on the line at the same time. This can be more easily achieved if the factory lay-out is such that all these users, even though their functions be diverse, can be kept under the control, or at least the supervision, of one man. So far as is consistent with other economic or process requirements, the size of the units may be arranged to approximate to a continuous process as regards their service demands.

Steam Accumulation

Where steam peaks of big amplitude cannot be avoided, but are of short duration, the steam accumulator may be the correct tool to use. The capital cost of boiler-plant installation may be reduced and the practical economy of steam raising improved by smoother working, but the capital cost of the accumulator itself is high, and its operation is based on the unsound practice of degrading energy, since the potential of the steam is lowered irreversibly without the benefit of producing power. The pass-out engine or turbine avoids the latter disadvantage, and may help to level out the load on boilers when steam load fluctuations are of longer duration and moderate amplitude. Their use is particularly appropriate where there is a constant power load.

From the point of view of power and heat balance, process works can generally be divided into three groups: (1) those in which the heat required for process use can just be made to generate the amount of electrical or mechanical power which is required; (2) those in which the heat requirements are in excess of the amount needed for power purposes; and (3) those in which the power requirements cannot be met by utilising the process heat through the highest practicable temperature range in a heat engine. The balanced factory is the ideal, but it can only rarely be achieved, and it is generally found that the balance tends to become upset. The reasons for this are that advances in heat economy are usually greater than those of power, and measures taken to economise labour usually involve increased use of power, so that requirements for the latter tend to predominate.

Where the amount of power required is less than could be generated from the heat requirements by means of efficient plant, it is obvious that the first step is to adopt every possible means of heat economy. If, after this has been done, the heat requirements are still in excess, this fact should be no excuse for not generating every available kW of power. The excess energy may be made use of in a variety of ways. It may be possible to instal an ancillary process offering a profitable use, *e.g.*, an electro-

lytic process. It may be possible to arrange to supply a neighbouring works, to the mutual advantage of both parties.

The most logical way of disposing of surplus power is to to deliver it into the supply authorities' mains. This is not usually permitted, or at best, no credit is given. This is a national calamity. Such export of power should be encouraged wherever it is possible, even in the case of small capacities, and full credit should be given for it, either as a money payment, or at least as a valuable offset against the cost of stand-by capacity provided by the supply authority.

Heat Pumps

When a factory presents an unbalanced condition of this type, it may be well worth while considering the use of vapour recompression or other form of heat pump. The suitable case would be one in which a very large quantity of heat is required at a low temperature. In such a case, less than the total heat requirement would be generated in the boiler plant as high-pressure steam. This steam would be used to drive an engine or turbine and exhausted to provide part of the process heat requirement. The power of the engine would be used to drive the compressor of the heat pump taking heat from the warmest available source and raising its temperature sufficiently to provide the remainder of the heat requirement. The amount of heat so pumped depends on the relation of the temperature of use to that of the heat source, but may be several times that of the heat extracted from the original steam by the engine.

Vapour recompression evaporators using rotary or steam jet compressors, a type of heat pump in fairly common use, are likely to be high in capital cost and call for high quality management and maintenance, but they should not be ruled out without adequate investigation. It will certainly be necessary to design the process and the heat transfer arrangements to use the heat at the lowest possible temperature in order to obtain the highest possible coefficient of performance.

Back Pressure Operation

The third case is that of the factory which requires more power than can be generated from the heat which is needed. Here the first problem is to decide how much power can be produced from back pressure or pass-out machines working between the highest and lowest temperatures and pressure which can be justified. The selection of these figures has already been discussed. The next question is how the balance of the power is to be obtained. It may be done by increasing the condensing capacity of the pass-out sets or by installing additional condensing machines. It must, however, be remembered that while back-pressure operation, with profitable use of the exhaust steam, offers efficiencies with which no condensing station can compete, as soon as condensers are employed, the plant is in direct competition with the central station, and unless it is on a very large scale, it is not likely to show to advantage.

The best all-round fuel economy will normally be obtained by generating as much power as the process steam will produce in a straight back-pressure machine, and by taking the balance of the power requirements from the supply mains. The generator of the back-pressure machine should be paralleled with the incoming supply, and the set should be governed to maintain constant pressure in the back-pressure mains. This arrangement will ensure that every lb. of process steam will generate its quota of power, except that, with an extremely peaky steam demand, it may be in the interests of capital and running economy to by-pass the highest peaks of short duration through a reducing valve.

Stand-by Power

The usual cause of the frustration of such schemes for national fuel economy is the refusal of the supply authority to permit parallel running, or alternatively, the price demanded for stand-by capacity is so excessive that the arrangement is put out of court on economic grounds. The obvious alternative is to instal stand-by capacity in the factory, but in the case of small and moderate-sized plants, this is not the most reasonable solution, if a broad view is to be taken of the national economy of capital equipment. In determining the price which should be paid for stand-by capacity, the chief engineer of a municipal supply department once stated that he must make a charge high enough to pay for installing and maintaining additional cables, switchgear, generators, and boilers capable of providing the specified capacity at all times. Such an attitude is disingenuous. Any chief engineer of a supply authority knows the value of diversity, and should give credit for it in this respect as much as in any other.

If a factory requires a really large supply of electrical power together with a moderate quantity of steam, both at a high load factor, there should be a first-class case for building the factory alongside a central station taking the power direct from the station bus-bars with low transmission costs and losses, and the steam by stage bleeding from the turbines. Unfortunately, it is difficult to find an authority which will co-operate in such a scheme.

It is to be hoped that in a few years it will be possible to solve the problem of works which require large power and little heat by the installation of gas turbines, exhausting to waste heat boilers.

Just as a factory should be so laid out that long ranges of steam mains are avoided,

so also the designer should take account of the handling of materials with a view to economy of labour, capital and power. If the process involves the handling of very large quantities of materials continuously throughout the year, there should be little difficulty in devising a satisfactory arrangement. Incoming wagons of bulk materials may be weighed and emptied on wagon tipplers, and the material may be conveyed by belt conveyors and put into stock piles or withdrawn from them by such means as scraper conveyors, or in the extreme case by bulldozers and by scraper excavators. In such cases, the economy of capital, labour, and power would be high and the most important points to watch are good management and maintenance. In works where the quantities are small and diverse, portable conveyors and mobile cranes may be the best tools to use. Labour economy will probably be the most vulnerable factor.

Utilisation Factor

Usually, the most difficult cases are those works of moderate size where fairly large quantities of diverse materials have to be handled. The worst case of all is that in which materials have to be dealt with at high rate, say, as ships' cargoes, but on only a few occasions during the year. At these times, heavy equipment is badly needed, but the high capital commitment cannot be justified owing to the low utilisation factor.

The solution to aim at is so to lay out the factory that, if possible, several such handling duties are grouped in such a way that they can all be dealt with by the same equipment. For example, one railway wagon tippler might be arranged to discharge boiler fuel as well as cargoes of sulphur or other bulk material. Although the capital cost of the tippler might not be justified for either duty separately, it may be economical for the combined quantities. Such a scheme can be arranged only if the works are so laid out that each material can be delivered from the tippler to its proper destination by a practical system of conveyors and elevators.

A valuable tool for some mixed duties is the overhead telpher crane, with or without grab. The crane can be arranged to command a length of siding on which wagons may stand, as well as a number of stock piles or receiving hoppers, so that each material concerned may be discharged from wagons to stock, and from stock to the point of usage by the same machine. A grab will not discharge wagons as effectively as a tippler since it is always necessary to clean up the bottom of the wagon by hand. However, there is a considerable economy in labour as against hand discharging, and the capital cost need not be excessive since, as well as discharging, the crane may do its own conveying and elevating.

A valuable application of a telpher crane and grab may be the rough blending of boiler fuels. Alternating grabs-full can be taken from two wagons or stock piles containing different types of coal. They should preferably be dumped into separate hoppers with feeders delivering on to a mixing belt or worm conveyor. If no such plant is available, alternating grabs may be dropped direct into the boot of the elevator or other plant which feeds the stoker. No one would claim that such an arrangement gives real blending, but in the works for which the author is responsible some of the fuels which are received will not burn on the grates to give anything like the output which is required, unless some less bad coal is mixed in this way.

The Scotch derrick and grab is another type of installation of moderate capital cost which might be used to handle a variety of materials from wagons into or out of stock piles disposed radially around it, and such an arrangement could also no doubt be used for mixing fuels. This crane calls for a rather higher level of skill to operate it safely, than is the case with the telpher, and the area which it commands cannot be so readily extended as can that of the telpher.

Economy of Water

The use of water for process purposes often has aspects very similar to those of the use of steam. Water is commonly used for two purposes, (a) for transferring heat both for heating and cooling operations, and (b) for process reactions and solution, under which heading may be included many cases of scrubbing effluent gases and the removal of waste products. These two aspects can often be considered together with advantage, since (for example) water for reaction may be required at a temperature which can be provided by the carrying out of a cooling operation.

When water is used for removing heat, it is frequently required to do so at the lowest available temperature. In this respect, its use is analogous to, but the inverse of, the use of steam for heating, and just as heat should, where possible, be applied at its highest temperature to make the intake temperature a maximum, so also cooling water should be applied to the same service at its lowest temperature in order to make the exit temperature a minimum.

Water is in itself a valuable commodity, but in almost all cases its use involves capital cost for installation and power for pumping. After use for low-temperature cooling, it should be passed on progressively through duties which may be cooled at successively higher temperatures and finally, having collected all the low-grade heat which may be made available in this way, it should be appropriated to those duties in which this

low-grade heat may be valuable, either for space heating, lime-soda water softening, or boiler feed.

Once again, these economies will be most easily and effectively achieved if they receive consideration in the early stages of design.

Economical Use of Labour

A wide use of unskilled labour is often associated with a saving of capital costs and a saving of the use of skilled labour for the maintenance of machines. As an example, a battery of hand-fired Lancashire boilers, does not generally make heavy demands on the maintenance and instrument departments or on the laboratory for the control of feed water. Even the engineering staff will not often be called out in the middle of the night because the coal is putting the fires out.

On the other hand, highly rated water-tube boilers with mechanical firing reduce the amount of unskilled labour which is required, but make heavier demands on the service branches. While full automatic control will probably not save one man per shift on the firing floor, it will certainly call for a substantal fraction of an instrument man and probably a fitter or electrician to keep it working. Justification for automatic control should be looked for in more efficient boiler operation and greater power production by maintaining a more constant stop-valve pressure on the turbine or engine.

A CO_2 recorder can be a most valuable aid to increasing the day-to-day combustion efficiency of boiler or other furnaces. It is useless to instal such an instrument unless provision is made to keep it in good working order, and to apply the information which it makes available. In order to get the best results in this direction, it may be that a bonus should be paid on CO_2, but this may be a dangerous cause of discontent unless the instruments are kept in first-class working order, and for this purpose, a man of good intelligence and skill and of high integrity must give an important part of his time to this one job. The savings should very well cover this expenditure; but in planning a factory provision must be made for an adequate instrument department and workshop, and it is advantageous if this shop can be close to the engineers' office so that to the man in charge of instruments can be assigned the duty of bringing to the attenton of the chief engineer any notable or unusual irregularities or other information which the instruments provide.

Capital and Management

Reference has been made to the relation between capital expenditure and other aspects of economy. Chemical processes differ in the extent to which capital charges influence total costs. In the case of fine chemicals, they are not usually very important, and there should be very little case for restricting fuel economy measures on this score. On the other hand the smaller fine chemical companies do not always spend enough money on good engineering management to ensure high energy efficiencies. It is on the heavy chemical side of the industry that capital charges often assume significant proportions, and once the capital cost of the equipment has been incurred nothing can be done to reduce these costs, except by writing off against profits, or by increasing the output of the plant.

Since chemical plant is always subject to change and improvement of process its value must usually be written down in a fairly short period, and this fact increases the difficulty in justifying heavy expenditure on items which will increase fuel economy, *e.g.*, those large heat transfer surfaces which make for small irreversible heat drops. Fortunately, steam raising and power generating plant can generally be written off over longer periods, and it is therefore easier to show cause for installation of the best and most efficient plant which is available.

Poorer Fuels

It appears that in the future much heavier capital costs will have to be carried for firing equipment. In the past there was good justification for providing moderate-sized boilers with simple grates and induced draught only, to burn good quality washed and sized coals, but now that there seems to be no prospect of obtaining anything but slacks of widely varying volatile, ash, moisture, and screen analysis, it is necessary to adopt much more costly plant to ensure maintained efficiency and, what is even more important, maintained ability to carry the factory load.

The capital cost of extensive instrumentation will be high, and if it is not combined with good management to make use of the data thereby obtained, this cost will be of no avail, but on the other hand good managers will be used at something less than their maximum efficiency if they are not provided with adequate instrument records.

In drafting this paper, an attempt has been made to show that isolated projects for fuel economy may be hampered or even rendered abortive unless works and processes are designed from the outset with due consideration for all the factors reviewed. It is admitted that, in the main, problems have been propounded without defining their solutions. This is inevitable, since an equation having so many variables must have many solutions, and usually the correct answer can be found only by successive approximations, that is to say, by the hard road of working out the over-all cost of a number of alternative schemes until the cheapest has been determined; in this con-

nection, consideration of which plan is the cheapest should take account of what assets are nationally most cheaply available.

There is only one way in which these calculations may be curtailed, and that is by the application of wide and intelligently assimilated experience, but it should be remembered that even such experience must be reassessed in the light of present and future conditions of stringency.

The main fact which emerges is that, as the power to calculate and the power to exercise judgment are both required in high degree if works are to be designed and built for the best economy, then it is only by employing designers and managers of the highest quality and in adequate numbers that this country will be able to offset its shortage of other assets, and so compete successfully in world industry.

Chemical Industry in Austria

Former Influence of I.G.

THE position of the chemical industry in Austria is at present influenced not only by present conditions but also by circumstances going back to before 1938. In consequence of the dominating influence of the German chemical industry, especially of the mammoth concern of the I.G. Farbenindustrie, Austria never developed a domestic wholesale manufacture of chemical products although various endeavours were made. Only in a few products, *e.g.*, production of sulphuric acid, superphosphates and other heavy chemicals, was home production established, but for most chemical products there was dependence on Germany. This dependence increased between 1938 and 1945 Although the manufacture of chemical products in Austria increased, and new factories started, the unfavourable situation which existed before the war has not really improved.

This unfortunate situation, which would handicap the future large-scale production of heavy and fine chemicals, has been recognised by the authorities. Serious efforts now being made to create a chemical industry based upon domestic raw materials and upon foreign semi-finished products, which would in quantity and quality correspond more closely to the demands of the Austrian economy and would even allow for an export of chemical products. A prerequisite for such a development would be the clearing up of the now unsettled patent situation, agreements on credits, and, above all, the removal of German influence. As it is still uncertain in what way and how far the dominating I.G. Farben concern will lose its influence, or who will take it over, definite prophecies are not yet possible. But, as regards raw materials, it seems certain that a considerable advance by the Austrian chemical industry is possible, following the elimination of German competition in Austria and in many parts of Europe.

Domestic tar manufacture for the production of organic chemicals, especially phenol, which is going to start on a large scale next spring, will supply a future organic chemical industry with the necessary semi-finished products. Plastics, dyestuffs, salicylic acid, acetylsalicylic acid (aspirin) and various other pharmaceuticals will be produced. Great importance is attributed to the proper use and consumption of petroleum and natural gas. By virtue of the extension of petroleum production, the raw material base for organic chemicals is on a better footing than in 1938. But it is still necessary to establish cracking plants to allow a sufficient production of benzene and its derivatives for home consumption. It may, in the long run, even be possible to export raw oil and oil products. The de-paraffining plants which are to be built would not only produce sufficient quantities of paraffin liquid and wax for the home market but would also leave a surplus for export. Up to now paraffin has had to be imported. The natural gas and the cracking plants would allow the production of solvents, such as methylene chloride, dichlorethylene, isopropyl alcohol, acetone, acetic acid ester and of certain bases, such as ethanolamine and morpholine, the production of which is already projected.

In the sphere of metallurgy it may be mentioned that as Austria possesses one of the largest aluminium works in Europe, aluminium and its alloys can be exported in large quantities. Similar conditions apply for magnesium because Austria disposes of the richest deposits of magnesite.

Efforts are being made to start iron smelting in electro furnaces, as in Sweden and Italy, whereby considerable quantities of coal could be saved. Austria has sufficient water power to produce cheap electricity which would be of the greatest value for metallurgical and electro-chemical works, *e.g.*, for the production of ferromanganese, ferrochromium, ferrosilicon and for the hardening and welding processes in electric furnaces.

All the problems mentioned above are being dealt with by a council of the Faculty for Chemistry at the Technical High School, Vienna for "Investigation of the Possibilities of a Rebuilding of the Chemical Industry in Austria." Its work already justifies an optimistic view of the future of the Austrian chemical industry.

I.C.I. and China

British Technicians Sent Out

IMPERIAL Chemical Industries may manufacture in China, in partnership with the Chinese, Lord McGowan, chairman of I.C.I. told an audience in London recently. Speaking at an Anglo-Chinese Chamber of Commerce luncheon at Grosvenor House, he said that before China could develop and expand her own industrialisation, with British financial help to aid the erection of factories, we should want to see political stability. "Investment," he said, "presupposes security of tenure and sound government, and speaking very frankly, those conditions do not at present exist. At the appropriate time I.C.I. is prepared to manufacture in China in partnership with the Chinese, and we have frequently exchanged ideas with Chinese interests, but the time is not yet ripe for developing that policy."

Lord McGowan said his company would strain every nerve to help China put her house in order. Already several I.C.I. technicians had been sent out, and they planned to send more.

Chemical Candidates

Widnes Council Redistribution

OWING to a rearrangement of the wards in the municipal borough of Widnes, more interest than usual is being taken in the election of borough councillors which is to take place on November 1. For the 24 seats which have to be filled, 44 candidates have come forward; and, as is not surprising in this great centre of the British chemical industry, not a few of them have intimate working connections with the industry. The following names are well known in local chemical circles, and many of them are of considerably wider reputation. Names marked with an asterisk are councillors seeking re-election.

Farnworth Ward: *Dr. J. P. Baxter, B.Sc., Ph.D. (Cons.), director, General Chemicals Division, I.C.I. Appleton Ward: Mr. F. J. Heyes (Cons.), Mr. F. J. Knight (Cons.), respectively chairman and secretary, Insulating Materials, Ltd.; Mr. Aneurin Williams, B.Sc. (Ind.), research chemist with I.C.I. (formerly United Alkali). Halton Ward: *Mr. J. H. Collins, B.Sc. (Lab.), research chemist with I.C.I.; *Mr. J. Fisher (Lab.), fitter in the Pilkington-Sullivan Works of I.C.I.; Mr. H. P. Minton (Ind.), a technical chemist who has been a member of the B.A.C. (Liverpool Section) for 25 years, and has served as chairman and councillor of the section; Mr. John Watson (Lab.), also a chemist with I.C.I., formerly in United Alkali. Woodend Ward: *Mr. R. Tough (Lab.), formerly assistant to Dr. Baxter at Billingham and now vice-chairman of Widnes Trade Union Council; *Mr. F. Traynor (Lab.), fitter at the Gaskell-Marsh Works of I.C.I. Kingsway Ward: *Mr. J. E. Bailey (Lab.), assistant physicist at Widnes Research Laboratory (I.C.I.); Mr. F. Tollitt (Lab.), of McKechnie Bros., head shop-steward for the C.W.U. Lowerhouse Ward: Mr. W. L. Dutton, A.R.I.C. (Lab.), analytical chemist at Widnes Research Laboratory, and founder-member of Widnes Branch, A.Sc.W. Ditton Ward: Mr. J. Longton (Cons.), on the I.C.I. clerical staff; Mr. C. McGloin (Lab.), at McKechnie Bros., a member of the C.W.U.

New Control Orders

Removals from Export Licence Control

SOME changes in the list of goods subject to export licensing control are made by *The Export of Goods (Control) (Consolidation) Order, 1946* (S.R. & O., 1946, No. 1661). Export licences now become necessary for dinitro-ortho-cresol preparations. The following no longer need licences for their export to any destination: Acetyl salicylic acid; arecoline and its salts; bismuth compounds; caffeine and its salts; chiniofon; chloral hydrate; chrysarobin; guanidine carbonate; guanidine nitrate; heparin; hydrastine and its salts and preparations thereof; hydrastis; 8-hydroxyquinoline and its compounds; liver extracts; mannitol; pancreatin; papaverine and its salts para-chlor-meta-xylenol; phenothiazine; pilocarpine and its salts; rhubarb (rheum); salicylic acid; senega; sodium salicylate; strychnine and its salts; sulphamethazine and its preparations; sulphathiazole and its derivatives and preparations thereof; thymol; urethane.

FOAM SUITS

It is reported in the *Journal of Chemical Education* that a protective "foam suit" which enabled men who fell into the sea to keep warm for two or three hours was developed in Germany during the war. A foam-producing powder was rubbed into the wool-like pile of an acetate rayon middle layer of a three-layer garment. The powder generated foam immediately upon contact with sea water. Foaming continued for a long period, even when the powder was greatly diluted. The resulting layer of foam between the middle and outer fabric layers of the suit protected the wearer from an excessive drop in body temperature. Foam powder for use in the North Atlantic and the North Sea contained sodium bicarbonate, citric acid crystals, benzoic acid crystals, a gelatin emulsion, and two other chemicals bearing German trade names.

Parliamentary Topics

Foreign Scientists in U.K.

IN the House of Commons, last week, Mr. Cobb asked the Minister of Labour whether he would give an estimate of the number of foreign scientists who had accepted permanent employment in this country during the last 15 years; and, in view of the prospective shortage of scientific manpower as envisaged in the Barlow Report, what steps were being taken to enlist the services of additional qualified foreign scientists until requirements could be supplied from British universities.

Mr. Isaacs replied that the answer to the first part of the question was "No, sir." In regard to the second part, every effort was made to utilise the services of foreign scientists in this country whose qualifications were in demand and who were known to be available. Though no general steps had been taken to enlist the services of foreign scientists from outside the U.K., arrangements had been made for the entry into this country of a number of scientists possessing knowledge and experience of a special value.

Labour in Foundries

Mr. Peter Freeman asked the Minister of Labour to what extent the placing of Italians and Germans in foundry work was due to shortage of labour and why apprentices to that work were being called to the Forces.

Mr. Isaacs said the proposed employment of Italians in ironfounding was entirely due to the shortage of suitable British labour. Deferment was given on application in the case of all young men in ironfounding, including apprentices.

German Development

The Chancellor of the Duchy of Lancaster, Mr. J. Hynd, was questioned by Mr. E. Davies whether the British Government was taking part in the loan for industrial development of Germany now being proposed by the U.S. Government. In reply, Mr. Hynd said H.M. Government was not participating. The American proposals, he affirmed, were designed not for the industrial development of Germany in general, but to finance the import of certain raw materials for specific export programmes.

Price Control

In a written question, Major Lloyd asked the President of the Board of Trade the average time taken by the Price Control Committee of his department in considering applications from a manufacturer to increase a selling price. Sir Stafford Cripps told him the information could not be obtained without an unjustifiable expenditure of time and labour.

Japan's Industries

Questioned by Mr. Rees-Williams about the ownership of industries in Japan, Mr. McNeil said that the great holding companies which had a stranglehold on Japanese industry were to be dissolved. A Holding Company Liquidation Commission had just begun work in Tokyo, and the question of the ownership of industries after the break-up of the holding companies was under discussion in the Far Eastern Commission.

Admiralty Chemists' Pay

Colonel Wheatley asked the Parliamentary Secretary to the Admiralty whether he would give an assurance that the carpenter scientific staffs of the Armament Supply Department would be placed on the rates of pay in accordance with the White Paper with regard to the Scientific Civil Service, 1945, and thus bring them into line with the carpenter scientific staffs in other Admiralty Departments.

Mr. W. Edwards: "No, Sir. I assume that the staff whom the hon. and gallant Member has in mind are chemists employed on the production side of the Royal Naval Propellant Factory. The revision of their rates of pay is, however, under consideration."

Penicillin Control to Remain

Sir John Mellor asked the Minister of Supply whether he was satisfied that sufficient penicillin was now available for United Kingdom requirements, and whether he would revoke the Control of Penicillin Order. Replying, the Minister of Supply (Mr. John Wilmot) said that although the supply position had improved considerably, the removal of control measures would not be justified at present. The scope of the Order was, however, being extended to allow registered veterinary surgeons to acquire penicillin supplies. He thought it undesirable to allow penicillin to be used indiscriminately. In answer to a later question the Minister admitted that British penicillin was now being exported.

Metal Containers

Colonel Wheatley asked the Minister about the shortage of large metal containers, and was told the position was being reviewed.

The opening of the asbestos deposits in the Lewis Brook area of Newfoundland has been started by a Canadian asbestos-mining concern. Samples with a 30 per cent. asbestos content have been reported, and it is stated that the iron content is low.

Personal Notes

MR. BOB EDWARDS, North-West area officer of the Chemical Workers' Union since 1938, has been appointed assistant general secretary.

The following have been appointed lecturers in the Chemistry Department of the Sir John Cass Technical Institute, London, E.C.: DR. W. WILSON, M.Sc., A.R.I.C., from Northampton Polytechnic; MR. F. HOLMES, B.Sc., A.R.I.C., from Woolwich Polytechnic.

DR. JOHN EGGERT, formerly Professor of Physical Chemistry and head of the central laboratories of the I.G. Farbenindustrie-Agfa in Berlin and Bitterfeld, has been appointed by the Swiss Federal Council to the post of Professor of Photography at the Federal Technical College, Zürich.

DR. C. H. LANDER, president of the Institute of Fuel, has accepted an invitation from the Minister of War to act as Dean of the Military College of Science at Shrivenham, Wiltshire. He will be specially concerned with the civilian side of the instruction provided.

DR. H. GOTHFELDT, M.Inst.W., has been awarded by the Council of the Institute of Welding the Sir William J. Larke Medal and a prize of £50, for a paper entitled "Welded Drag Line Booms of 150 feet Length." The paper, which describes the fabrication of welded drag line booms for use in open-cast coal workings, will be read at a meeting of the Institute in London on October 31.

DR. PATRICK D. RITCHIE, present head of the chemistry department at Leeds College of Technology, has been appointed head of the department of chemistry of the Central Technical College, Birmingham, following the retirement of Dr. J. A. Newton Friend. Dr. Ritchie has done a great deal of research in plastics, and when he takes over his new duties in January he will direct a new laboratory devoted to education in the technology of plastics.

PROFESSOR J. HEYROVSKY, director of the Physico-Chemical Institute, Charles University, Prague, and inventor of the polarograph, is on a visit to Britain arranged by the British Council. He is visiting the National Physical Laboratory, the Royal Institution, the Imperial College of Science and other Institutions, and is lecturing to University and professorial audiences at Sheffield, Leeds, Cambridge, and Aberystwyth.

DR. T. W. J. TAYLOR, C.B.E., M.A., D.Sc., Fellow of Brasenose College, and Lecturer in Chemistry in the University of Oxford, has been appointed principal-designate of the new West Indian University College which is to be established in Jamaica, in accordance with a decision of the Secretary of State for the Colonies. Dr. Taylor is well known in many chemical fields outside Oxford, having served on the Council of the Chemical Society in 1936-39, and having been a governor of the Royal Holloway College in the University of London. Among his numerous chemical publications probably the best known is his new edition (1937) of Sidgwick's *Organic Chemistry of Nitrogen*, in collaboration with Dr. W. Baker. Dr. Taylor's appointment is effective from October 1, 1946.

Obituary

MR. OTTO CYREN, a director of the Swedish Department of Chemical Industry since 1944, and a well-known chemical engineer, died in Sweden on September 23, aged 68. Educated in the Chalmers Institute at Gothenburg, his birthplace, and at the Zürich Polytechnic, he gained experience in various chemical works in Germany before returning to Sweden in 1917.

A New Insecticide

Brought from U.S.A. by Dr. West

THE announcement of a new organic insecticide, Velsicol 1068, was made last Tuesday by the Hygienic Chemical Company at a luncheon at the Savoy Hotel, London. Among the many guests who heard details of the new compound were well-known chemical manufacturers, industrialists, academic scientists, and representatives of the daily and technical Press.

Dr. T. F. West, well known for his DDT studies, was responsible for the introduction of Velsicol to this country. He explained that it will be slightly more expensive than DDT, but emphasised that it will be complementary to DDT and Gammexane. The new insecticide is a little more toxic to animals than DDT, but it can be used at greater dilutions. Velsicol he claimed, is more toxic than other substances against certain stages of development of the German cockroach. It is also exceptionally effective against bugs, grain insects, houseflies, locusts, mosquitoes, and an aphid.

The new insecticide was discovered in the laboratories of the Velsicol Corporation in Chicago, following publication of a theory to explain the reason for the insecticidal activity of DDT put forward by two British workers, Dr. Hubert Martin, and Dr. R. L. Wain. The compound has the composition $C_{10}H_6Cl_8$, which provided part of its trade name.

Further details of this compound will be given in a later article in THE CHEMICAL AGE.

A CHEMIST'S BOOKSHELF

THE CHEMISTRY OF FREE RADICALS. By W. A. Waters. Oxford University Press. Pp. 284. 20s.

If one were asked for a generalisation on the trend of organic chemistry it would be fair to say that until recently most energy has been expended in the preparaton of compounds and the elucidation of their relation to each other, while a large amount of present-day research is directed at answering the question how a certain reaction takes place. If a relatively simple reaction is considered, from either organic or inorganic chemistry, it is surprising to find that in many cases there is no clear idea as to how the reaction occurs. Such, for instance, is the case in the Gatterman reaction where copper powder appears to have a catalytic effect on a diazonium salt.

Since classical organic chemistry had put forward the view that a radical was a group of atoms which remained unchanged in most sequences of reactions and could not exist separately, a great deal of interest was aroused by Gomberg's discovery, in 1900, of the free radical triphenylmethyl which he prepared from hexaphenyl-ethane. A whole range of analogous compounds was formed soon afterwards, although it was not until 1929 that Paneth and Hofeditz obtained evidence for the existence of free methyl.

Free radicals have been defined by Wieland as "complexes of abnormal valency, which possess additive properties, but do not carry an electrical charge and are not free ions," and it is with such complexes that Dr. Waters's present book deals.

The introductory chapter consists of a short historical approach where the discovery of the more important free radicals is reviewed and the original apparatus used is illustrated and described. The following chapter deals with the physical properties of free radicals and it is to be noted that since they always contain an odd number of electrons they will be paramagnetic, a fact which affords a convenient method of estimating the degree of dissociation into free radicals. A description of the methods available for the preparation of free radicals is then given and, since the author has drawn no arbitrary distinction between the branches of organic and inorganic chemistry, this also includes a description of such radicals as atomic hydrogen, nitrogen, and chlorine.

The remaining chapters give an account of the various reactions which involve free radicals. These reactions are taken from all branches of chemistry and are grouped according to their fundamental mechanisms. Thus we have a chapter on each of the following topics: reactions of alkyl radicals, aryl radicals, radicals as catalysts, reactions involving metals, oxidation, and finally a chapter briefly outlining some possible mechanisms in biochemistry which may be accounted for by assuming the occurrence of free radicals.

In the course of these chapters such widely different topics as the Kolbe reaction, diazonium solutions, Perspex, and electrode reactions are dealt with. Throughout there are numerous references to the literature and, in view of the otherwise excellent way in which the subject matter is presented, it is a pity that these references are indicated by asterisks and daggers, etc., in such a way as to make them indistinguishable from the accompanying footnotes.

The present volume is the first book of its kind to be published in England and as such has set out to review all the pertinent experimental work to date from which conclusions have been drawn and in some cases theories propounded. Whether these prove to be correct, only time, and further research, will tell. The book may be confidently recommended to a very wide range of scientists. It is a volume, not only for the physical chemist who is interested in rates of reaction, but for all chemists, whether they specialise in organic or inorganic work, who are interested in finding an answer to the question of how substances react. It will likewise be appreciated, both as a textbook and a work of reference, by the industrial chemist concerned with macromolecules, since due mention is given to synthetic polymers.

WHERE TO FIND INFORMATION ON THE GERMAN CHEMICAL INDUSTRY. By L. Wilson Greene. Published by the author, 54D Oak Grove Drive, Baltimore, Maryland. Pp. 40. $1.

The author of this useful little bibliography is Senior Consultant to the Chemical Corps Technical Command U.S. Army, and formerly held important staff appointments in the U.S. Chemical Warfare Service; so that it is to be expected he should have a good knowledge of American literature dealing with the subject in hand. What is perhaps not surprising, but at any rate gratifying, is that he is conversant also with the material published in England, so that his bibliography is made the more complete. It is arranged conveniently in two sections, one covering published articles, the other a list of the most important reports that can be bought from the U.S. Office of Technical Services; and it is provided with a concise subject-index. The author adds a note to the effect that he is planning a similar guide to the German metallurgical industry, and would appreciate suggestions furthering the utility of such handbooks.

General News

Nine people were injured, six being detained in hospital, when a refuse bin exploded outside Messrs. Bibby's, Liverpool.

The present procedure, whereby veterinary surgeons obtain penicillin through specially licensed suppliers, will end on October 31.

A fire at the Pan Britanica fertiliser factory at Sewardstone Road, Waltham Abbey, was confined to the first floor by firemen from Ponders End, Enfield and Waltham Abbey.

The radio telephone service to liners at sea is now available from 7.15 a.m. to 9.15 a.m., and from 12 noon to 8 p.m. G.M.T. daily, except on Sundays.

The Textile Institute announces that William Parkin (Bradford Technical College) was among this year's successful candidates in the final examination for the Ordinary National Certificate in Textiles.

A Drug Requirements Advisory Committee to " compile a list of those drugs considered to be necessary for the health of the community " is to be set up by the Ministry of Health.

Unregistered air mail letters at 1s. 6d. per half oz. may now be sent to Korea, and unregistered postcards, relating to personal and domestic matters only, may be sent to Japan.

The Great Western Railway has placed an order with British Brown-Boveri Limited for a gas turbine locomotive which will develop an output of 2500 h.p. and be capable of a maximum speed of 90 m.p.h.

Glasgow Corporation's Provan chemical works are to be extended in conjunction with Provan Corporation gasworks, by the installation of two modern units, one to produce sulphate of ammonia and the other to distil tar acid.

The Ministry of Supply announces that the stock of non-ferrous scrap metals on charge on September 30 was 183,752 tons. Sales for the two months August-September amounted to 18,286 tons (approximate value £910,000).

A submarine cable, 200 nautical miles long and insulated with polythene, has been laid direct to Germany since the end of the war. This is the longest telephone cable between this country and Europe. A submerged repeater has been included in the cable.

During August the following cases were reported under the Factories Act or the Lead Paint Act. Lead poisoning, 1; aniline poisoning, 4; anthrax, 1; skin cancer, 32. (pitch 16, tar 14, oil 2); chrome ulceration, 2. There was one death from lead poisoning —a metal smelter.

From Week to Week

The telephone service between this country and Bulgaria has been restored with a minimum charge for three minutes of 24s. from England and Wales, and 2s. 6d. extra for calls from Scotland, Northern Ireland and the Isle of Man.

The strike of 400 workers at the Rutherglen works of Messrs. J. & J. White, Ltd., chemical manufacturers, which has been in progress for four weeks, shows no sign of ending soon. Strike action was taken by the men when several employees were dismissed on the grounds of redundancy.

At a conference held in Glasgow last Saturday a project was discussed for setting up a coal-distillation plant in the Shotts district, with a view to revitalising the industry of Lanarkshire. It is expected that the projected scheme, through the creation of subsidiary industries, would give employment to some thousand workers.

A Northern Ireland branch of the Society of Dyers and Colourists has been formed, with officers as follows: chairman, Dr. T. E. Ellison; hon. secretary, Mr. J. Porter, 20 Abbeydale Gardens, Crumlin Road, Belfast; committee, Mr. E. Butterworth, Mr. D. A. Derrett Smith, Dr. M. Gewing, Dr. W. Honneyman, Mr. J. H. Jackson, Mr. W. J. Macnab, Mr. J. Montgomery, Mr. F. C. Oldham, Mr. J. A. Rodgers.

Before he left the Colonial Office to take up his new post as First Lord of the Admiralty, Mr. George Hall announced the appointment of six members of the Colonial Development and Economic Council which is to advise on the plans for economic and social development in the colonies. The six members are Viscount Portal, Mr. J. Benstead, Sir Bernard Bourdillon, Sir Graham Cunningham, Sir William Goodenough and Sir Drummond Shiels.

Illustrated descriptions of all inventions patented in the United Kingdom are published in *Abridgments of Specifications of Inventions* issued by H.M. Patent Office. This publication constitutes a record in classified form of recent developments in all branches of invention for which patents have been granted and is invaluable to research students and specialists. The Abridgments are divided into 40 Groups, each Group relating to a special field of invention, a volume of each Group as issued covering a series of 20,000 published specfications of inventions. The volumes now in course of preparation can be supplied sheet by sheet (16 pages) post free as issued for a subscription per vol. of 5s. (inland); 7s. 6d. (abroad) The number of the Group or the subject of interest should be sent with all subscriptions.

Civilian travellers entering or leaving Britain may carry £20 in sterling notes, states a new Treasury Order. Outward-bound travellers may also take £10 worth of foreign currency, and inward-bound travellers may bring in varying amounts in foreign notes, according to the currency involved. No restrictions are placed on the passage of sterling or foreign notes between the U.K., Eire, and the Channel Islands.

A sound-colour film made by Potash, Ltd., and dealing with different aspects of fruit, vegetable and flower culture in the principal horticultural areas in Great Britain has just been released. According to general opinion, this film achieves a high standard of quality in colour reproduction and other technical features. Applications for demonstrations from N.F.U. branches, horticultural societies and clubs should be sent to the Field Service Department, Potash Limited, 112 Fenchurch Street, London, E.C.3.

Foreign News

The production of tin at the Longhorn smelter in Texas is increasing steadily and current operations are at the rate of about 44,000 tons a year. The Texas City smelter began operations in April, 1942, and has already produced about 150,000 tons.

The first catalytic petroleum-cracking plant in Canada is to be erected at Montreal East, by Imperial Oil, Ltd. The programme includes the construction of a polymerisation plant with a daily capacity of 4200 barrels, it is reported.

Under the terms of a trade agreement which is being discussed between the French Government and an Austrian delegation, France would supply chemical and pharmaceutical products, fertilisers, and other goods in exchange for steel, magnesium and timber.

A commercial agreement has been concluded for the period ending April next, between Sweden and Eire, by which, in exchange for Swedish timber products, plywood, paper and pulp, Eire will supply Sweden with woollen goods and mineral products of various unspecified categories.

In the U.S. zone of occupation in Germany, raw graphite is being imported from Austria, while Yugoslavia has bought graphite electrodes, manufactured in the zone, to the value of $12,000. Norway and Sweden have each contracted to import 300 tons of bauxite from the same zone.

The Swiss Society for Analytical and Applied Chemistry held its annual general meeting recently in Solothurn. A number of delegates from foreign universities attended. Ten papers were presented including one by the president, Dr. R. Viollier, Basle, on "Physico-Chemical Methods for the Characterisation of Proteins."

The sunflower-seed crop in Argentina for this year is officially estimated at 890,000 metric tons, compared with 985,000 tons last season. The production of quebracho in 1945 was 726,565 tons of wood, which yielded 232,372 tons of extract, comprising 121,575 tons of the type soluble in cold water and 110,797 tons of the type soluble in hot water.

Copper acetate and a black water-soluble dyestuff bonded with a wax binder have been used by the U.S. Navy as a shark repellent in the Pacific. At first copper acetate alone was used, and, diffusing slowly into the water, the chemical repelled sharks; but since sharks have a visual response to food as well, the black dyestuff was added to make the repellent more effective. One bag of the acetate hung below water gave protection for about three hours.

Forthcoming Events

October 26. Institution of Chemical Engineers (North-Western branch, jointly with Liverpool section of S.C.I.). Stork Hotel, Queen Square, Liverpool, 3 p.m. Dr. L. J. Burrage: "Some Aspects of Adsorption by Activated Charcoal."

October 26. Royal Institute of Chemistry (London and South-Eastern Counties section). Letters Lecture Theatre, Reading University, 2.30 p.m. Professor H. L. Hawkins: "The Geology of Water Supplies"; Mr. W. Gordon Carey: "The Chemistry and Bacteriology of Water Supplies."

October 28. Society of Chemical Industry (Agriculture and Food Groups). Chemical Society's rooms, Burlington House, Piccadilly, London, W.1, 6.30 p.m. Professor G. L. Baker: "Agricultural Delaware and its Supporting Research"; Professor J. A. Scott-Wilson: "Agricultural Research and Farming Progress."

October 29. Hull Chemical and Engineering Society. Jackson's Restaurant, Paragon Street, Hull, 7.30 p.m. Annual dinner.

October 29. Society of Instrument Technology. Royal Society of Tropical Medicine, Manson House, Portland Place, London, W.1, 7 p.m. Mr. S. Hill: "The Standard-Sunbury Engine Indicator."

October 29. The Chemical Society (jointly with Edinburgh University Chemical Society and local sections of R.I.C. and S.C.I.). Edinburgh University, 7 p.m. Dr. D. J. Bell: "Some Observations on Biological Oxidation and Reduction."

October 30. British Association of Chemists (London Section). Gas Industry House, 1 Grosvenor Place, London, S.W.1, 7 p.m. Mr. H. C. Stephenson: "Protection Against Industrial Poisons."

October 31. Royal Institution. 21 Albemarle Street, London, W.1, 5.15 p.m. Professor J. R. Partington: "History of Alchemy and Early Chemistry—I."

October 31. Society of Public Analysts. Geological Society's Rooms, Burlington House, London, W.1, 6 p.m. Professor J. Heyrovsky: "The Fundamental Laws of Polarography."

October 31. Imperial Institute (Mineral Resources Department). Cinema Hall, Imperial Institute, London, S.W.7 (East Entrance), 3 p.m. Mr. C. B. Bisset: "The Work of the Geological Survey of Uganda."

November 1. Chemical Society. Joint meeting with University College of Swansea Chemical Society. University College, Swansea, 6 p.m. Professor D. H. Hey: "Homolytic Reactions."

November 4. Oil and Colour Chemists' Association (Hull Section) Royal Station Hotel, Hull, 6.30 p.m. Professor T. P. Hilditch: "Mechanism of Oxidation and Reduction of the Unsaturated Groups in Drying Oils."

November 4. Society of Chemical Industry (London Section; joint meeting with the Institute of Fuel). Institution of Electrical Engineers, Savoy Place, London, W.C.2, 6 p.m. Dr. C. C. Hall: "The Operation and Development of the Fischer-Tropsch and Related Processes in Germany."

November 5. Hull Chemical and Engineering Society. The Church Institute, Albion Street, Hull, 7.30 p.m. Dr. A. N. Mosses: "Fireworks in War."

November 5. Institution of Chemical Engineers. Geological Society's Rooms, Burlington House, London, W.1, 5.30 p.m. Mr. W. F. Carey: "The Effect of Using Hot Air in Grinding Systems."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CURWEN-MILLER CO., LTD., Bristol, paint and polish manufacturers. (M., 26/10/46.) September 30, £3000 (not ex.) mort., to Lloyds Bank, Ltd.; charged on 43 Stokes Croft St. James, Bristol. *Nil. December 30, 1944.

BRITISH CELANESE, LTD., London, W. (M., 26/10/46.) September 24, Trust Deed dated September 16, 1946, securing £1,000,000 3½ per cent. second debenture stock 1951/80 with a premium of 2 per cent. in certain events; general charge (subject to etc.). *£3,722,761. December 25, 1945.

CARBO-ICE INDUSTRIES, LTD., Treforest. (M., 26/10/46.) September 26, debenture, to C. M. W. Trust, Ltd., securing all moneys and liabilities which are now or at any time hereafter may be incurred and actually paid by the holders under a guarantee but not exceeding £5000; general charge. *Nil. July 5, 1946.

VITREOUS ENAMELLING INDUSTRIES (BRADFORD) LTD. (M., 26/10/46.) September 26, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Alexandra Shed, Parsonage Road, Laisterdyke, Bradford, with machinery, fixtures, etc., also general charge.

ANTISEPTIC PRODUCTS, LTD., Maidstone, chemists. (M., 26/10/46.) September 12, charge, supplemental to a debenture dated September 1, 1945, to Anglo-Federal Banking Corporation, Ltd., securing all moneys due or to become due to the Bank; charged on 105 and 105a Tonbridge Road, Maidstone (subject to etc.). *£4,725. September 10, 1946.

Satisfactions

NUTILUS PRODUCTS, LTD., Kingston-on-Thames, chemists, etc. (M.S., 26/10/46.) Satisfactions September 30, of debentures registered October 31 and December 15, 1938.

STEWARTS & LLOYDS, LTD. (incorporated in Scotland). (M.S., 26/10/46.) Satisfaction October 3, of debenture stock registered February 8, 1934, to the extent of £19,000.

UNITED STEEL COMPANIES, LTD., Sheffield. (M.S. 26/10/46.) Satisfactions September 27, balances of £28,502 7s. 9d., £9052 6s. 9d. and £7250 19s. 6d., registered February 16, 1931.

Company News

Settle Limes, Ltd., have declared an ordinary dividend of 6 per cent. (4 per cent.) for the year ended July 31.

Sadler & Co., Ltd., with a net profit of £3104 (£4862) for the year ended June 30, are paying a dividend of 6 per cent. (5 per cent.).

Borax Consolidated, Ltd., announce that a final dividend of 3 per cent., less tax will be paid on December 2 on their preferred ordinary stock. The last time a final dividend paid so early was in 1929.

Murex, Ltd., announce a net profit, for the year to June 30 last, of £201,490 (£213,032). A final ordinary dividend of 10 per cent. and a cash bonus of 2½ per cent. make a total of 20 per cent. (same).

Aspro, Ltd., for the year ended June 30, report a net profit of £424,695 (£284,512), and have declared a final ordinary dividend of 25 per cent. (15 per cent.), making a total of 35 per cent. (25 per cent.).

British Alkaloids, Ltd. (manufacturers of "T.C.P.") are paying, in respect of the year ending March 31 next, interim dividends of 16.6 per cent. (10 per cent.) on the 8 per cent. participating preference, and 25 per cent (15 per cent.) on the ordinary shares.

New Companies Registered

Frago (Export) Ltd. (421,250).—Private company. Capital £100 in £1 shares. Exporters, importers, buyers, sellers and manufacturers of plastics, metals, chemicals, etc. Director: H. Barker. Registered office: 39-41 Swan House, 133 Oxford Street, W.1.

Furness (Coals) Ltd. (421,298).—Private company. Capital £50,000 in £1 shares. Chemical manufacturers, distillers, gas-makers, metallurgists, etc. Subscribers: P. H. N. Lewis; A. C. Hibbard. Solicitors: Middleton, Lewis & Clarke, 53 Leadenhall Street, E.C.3.

Chemical and Allied Stocks and Shares

STOCK markets have been dominated by the all-round advance in British Funds which followed Mr. Dalton's decision to redeem 3 per cent. Local Loans and replace the latter by a "tap" issue of 2½ per cent. Treasury bonds. Long-dated gilt-edged stocks led the advance, and other sections of markets have shown an upward adjustment of values. The rise, however, was not accompanied by any marked increase in the volume of business. Leading investments were adjusted upwards in price owing to the rise in gilt-edged, including the ordinary or equity shares of industrial companies. Home rails eased after their recent advance, but the prior charges moved higher again. Colliery shares responded to estimates of ultimate compensation values; but in some directions, notably Tube Investments, prices eased following news of the effects of steel shortages, although in such cases the tendency later became steadier on suggestions that the Ministry of Supply may agree to a revision of steel allocations.

Imperial Chemical at 42s., Dunlop Rubber at 69s. 9d., British Oxygen 95s. 7½d., and Lever & Unilever 49s. 3d. reflected the upward movement. Borax Consolidated deferred were good with an advance to 45s. 3d., the decision to pay the final dividend on the preferred ordinary shares at an earlier date this year having been taken as indicating confidence in the trend of the company's profits. Shares with bonus prospects (notably Vickers 10s. ordinary which advanced to 27s. 3d.) were favoured on hopes that the ban on share bonuses may be modified. Among colliery shares, which recorded a further all-round advance, Shipley were 44s. 9d., Staveley 58s., and Powell Duffryn 25s. 7½d. Steels were better, particularly Dorman Long, which rose to 26s., while United Steel strengthened to 25s. Colvilles were 25s., and Guest Keen 42s. 10½d. Babcock & Wilcox at 61s. 6d. xd responded to the good impression created by the unexpected increase in the interim dividend, while T. W. Ward moved up to 42s. 6d. in response to the victory bonus.

In other directions, the units of the Distillers Co. were prominent with an advance to 133s. United Molasses rose to 51s. 9d., and there was a rise to 65s. in Associated Cement. British Plaster Board were 32s. 6d., Radiation 55s. 7½d., and Metal Box shares strengthened to £5½, but following the news that the steel shortage has led to the closing of the works of a subsidiary, Tube Investments fell back to 3s. 1½d. to £6. Wall Paper Manufacturers deferred were 42s. 9d. following the higher dividend. General Refractories showed firmness at 19s. 3d., British Ropes 2s. 6d. shares were good at 11s., and various shares of other companies whose products are used in the heavy industries were favoured. Murex at 93s. 1½d. moved higher on the full results. Paint shares kept firm with Pinchin Johnson 45s., Goodlass Wall 29s. 4½d., and International Paint £6⅜. Turner & Newall moved up to 84s. 6d. partly on higher dividend hopes. There was a general rise in textile shares under the lead of J. & P. Coats which advanced to 61s. 6d. Calico Printers were 24s. 6d., Bradford Dyers 23s. 1½d., and Bleachers 12s. 9d. British Celanese moved up to 32s. 9d. on further consideration of the past year's results, and Courtaulds were 52s. 6d.

Boots Drug went ahead to 58s. 9d., Beechams deferred were 25s. 9d., Sangers 32s. 3d., but elsewhere, Triplex Glass eased to 35s. awaiting the full results and chairman's annual statement. Fisons were 55s., W. J. Bush 90s., and Greeff-Chemicals Holdings 5s. shares 11s. 9d. De La Rue moved up to £12⅝, and elsewhere Low Temperature Carbonisation 2s. shares rose further to 4s. 1½d. Oils failed to hold earlier gains, but Shell were 92s. 6d., and on higher dividend hopes Trinidad Leaseholds gained 5s. at 115s. 7½d.

Prices of British Chemical Products

THERE has been very little change during the past week in the London industrial chemical market, the chief interest being that of obtaining adequate supplies to meet a steady home demand and a sustained flow of inquiries for shipment. Production generally appears to be making progress under difficult conditions and contract deliveries have been well maintained, but the continued scarcity of spot offers in a number of directions has emphasised the tightness in the supply position. A good demand is reported for practically all the potash and soda products and the demand for lead oxides exceeds the available supplies. Firm price conditions have been maintained in the coal-tar products section and a good export market awaits material surplus to home requirements.

MANCHESTER.—The general run of industrial chemicals is finding a ready outlet on the Manchester market and the past week has seen a steady flow of new inquiries circulating from home consumers, with a fair number also, covering a fairly wide range of materials, from shippers. Contract deliveries of the alkalis, ammonia products, and mineral acids are being called for regularly, as well as many other compounds. Prices are strong in tendency in pretty well all directions. Fair buying interest is being displayed in superphosphates and one or two other sections of the fertiliser market, while in the tar products most lines are being taken up to the full extent of production.

GLASGOW.—Little change can be recorded in general conditions in the Scottish heavy chemical market during the past week. Deliveries against contract and orders for all classes of heavy chemicals have been well up to standard. The supply condition, however, show signs of deterioration and certain raw materials are exceedingly scarce. Prices show a marked tendency to rise, and generally the demand cannot be satisfied. Export inquiries and orders continue on a very brisk scale; considerable business has been noted in sulphuric acid, Glauber salts, sulphur, formaldehyde, copper sulphate, and tanning chemicals.

Price Changes

Rises: Arsenic; sodium chlorate; sodium nitrate; wood creosote; wood tar.
Falls: Calcium acetate; cream of tartar.

General Chemicals

Acetic Acid.—Maximum prices per ton: 80% technical, 1 ton, £47 10s.; 80% pure, 1 ton, £49 10s.; commercial glacial, 1 ton, £59; delivered buyers' premises in returnable barrels, £4 10s. per ton extra if packed and delivered in glass.

Acetone.—Maximum prices per ton, 50 tons and over, £65; 10/50 tons, £65 10s.; 5/10 tons, £66; 1/5 tons, £66 10s.; single drums, £67 10s.; delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each. For delivery in non-returnable containers of 40/50 gallons, the maximum prices are £3 per ton higher. Deliveries of less than 10 gallons free from price control.

Alum.—Loose lump, £16 per ton, f.o.r. MANCHESTER: £16 to £16 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER: £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—MANCHESTER: £40 per ton d/d.

Ammonium Carbonate.—£42 per ton d/d in 5 cwt. casks. MANCHESTER: Powder, £43 d/d.

Ammonium Chloride.—Grey galvanising, £22 10s. per ton, in casks, ex wharf. Fine white 98%, £19 10s. per ton. See also Salammoniac.

Ammonium Persulphate.—MANCHESTER: £5 per cwt. d/d.

Antimony Oxide.—£120 to £123 per ton.

Arsenic.—Per ton, 99/100%, £38 6s. 3d. to £41 6s. 3d., according to quality, ex-store.

Barium Carbonate.—Precip., 4-ton lots, £19 per ton d/d; 2-ton lots, £19 5s. per ton. bag packing, ex works.

Barium Chloride.—98/100% prime white crystals, 4-ton lots, £19 10s. per ton, bag packing, ex works.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £18 15s. per ton d/d; 2-ton lots, £19 10s. per ton.

Bleaching Powder.—Spot, 35/37%, £11 to £11 10s. per ton in casks, special terms for contract.

Borax.—Per ton for ton lots, in free 1-cwt. bags, carriage paid: Commercial, granulated, £30; crystals, £31; powdered, £31 10s.; extra fine powder, £32 10s. B.P., crystals, £39; powdered, £39 10s.; extra fine, £40 10s. Borax glass, per ton in free 1-cwt. waterproof paper-lined bags, for home trade only, carriage paid: lump, £77; powdered, £78.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial,

granulated, £52; crystals, £53; powdered, £54; extra fine powder, £56. B.P., crystals, £61; powder, £62; extra fine, £64.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid, £5 15s. per ton, ex store.

Charcoal, Lump.—£22 per ton, ex wharf. Granulated, £27 per ton.

Chlorine, Liquid.—£23 per ton, d/d in 16/17 cwt. drums (3-drum lots).

Chrometan.—Crystals, 5½d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Controlled prices per lb., d/d buyers' premises. For 5 cwt. or over, anhydrous, 1s. 6¾d., other, 1s. 5d.; 1 to 5 cwt., anhydrous, 1s. 9d., other, 1s. 7d. Higher prices for smaller quantities.

Copper Carbonate.—MANCHESTER: £8 15s. per cwt. d/d.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Sulphate.—£33 10s. per ton, f.o.b., less 2%, in 2 cwt. bags.

Cream of Tartar.—100 per cent., per cwt., from £12 14s. 6d. for 10-cwt. lots to £14 1s. per cwt. lots, d/d. Less than 1 cwt., 2s. 5½d. to 2s. 7½d. per lb. d/d.

Formaldehyde.—£27 to £28 10s. per ton in casks, according to quantity, d/d. MANCHESTER: £28.

Formic Acid.—85%, £54 per ton for ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1260 s.g., in tins, £4 16s. 6d. to £5 10s. 6d. per cwt., according to quantity; in drums, £4 2s. 6d. to £4 16s. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; carriage paid for bulk lots.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—11d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 10s. 4d. to 14s. 6d per lb., according to quantity.

Lactic Acid.—Pale tech., £60 per ton; dark tech., £53 per ton ex works; barrels returnable.

Lead Acetate.—White, 70s. to 75s. per cwt., according to quantity.

Lead Nitrate.—About £70 per ton d/d in casks. MANCHESTER: £70 to £72.

Lead, Red.—Basic prices per ton: Genuine dry red lead, £71; orange lead, £83. Ground in oil: Red, £92; orange, £104. Ready-mixed lead paint: Red, £99; orange, £111.

Lead, White.—Dry English, in 8-cwt. casks, £83 per ton. Ground in oil, English, in 5-cwt. casks, £102 per ton.

Litharge.—£68 10s. to £71 per ton, according to quantity.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £36 per ton.

Magnesium Chloride.—Solid (ex wharf), £27 10s. per ton.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., for 2-cwt lots, 9s. 1d.; smaller quantities dearer.

Mercurous Chloride.—10s. 1d. to 10s. 7d. per lb., according to quantity.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 3s. per gal.; pyridinised 64° O.P. 100 gal., 3s. 1d. per gal.

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—£100 to £105 per ton in ton lots packed in free 5-cwt. casks. MANCHESTER: £5 to £5 2s. 6d. per cwt.

Paraffin Wax.—Nominal.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £65 10s. per ton for 1-ton lots; flake, £76 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 7¾d. per lb.; ground, 8¾d. per lb., for not less than 6 cwt.; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £57 per ton for 5-ton lots, £57 10s. per ton for 1 to 5-ton lots, all ex store; hydrated, £51 per ton for 5-ton lots, £51 10s. for 1 to 5-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Iodide.—B.P., 8s. 8d. to 12s. per lb., according to quantity.

Potassium Nitrate.—Small granular crystals, 76s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 8½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 8d. per lb.; technical, £7 14s. 3d. to £8 6s. 3d. per cwt., according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—First lump, spot, £48 per ton; dog-tooth crystals, £50 per ton; medium, £48 10s. per ton; fine white crystals, £19 10s. per ton, in casks, ex store.

Salicylic Acid.—MANCHESTER: 1s. 9d. to 2s. 1d. per lb. d/d.

Soda, Caustic. — Solid 76/77%; spot, £16 7s. 6d. per ton d/d.

Sodium Acetate.—£42 per ton, ex wharf.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 6¼d. per lb.; anhydrous, 7½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite. — Powder, 60/62%, £19 10s. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2 cwt. free bags.

Sodium Chlorate.—£45 to £47 per ton.

Sodium Hyposulphite.—Pea crystals 19s. per cwt. (ton lots); commercial, 1-ton lots, £17 per ton carriage paid. Packing free.

Sodium Iodide.—B.P., for not less than 28 lb., 10s. 2d. per lb.

Sodium Metaphosphate (Calgon).—11d. per lb. d/d.

Sodium Metasilicate.—£16 10s. per ton, d/d U.K. in ton lots.

Sodium Nitrite.—£23 per ton.

Sodium Percarbonate.—12½% available oxygen, £7 per cwt.

Sodium Phosphate.—Di-sodium, £25 per ton d/d for ton lots. Tri-sodium, £27 10s. per ton d/d for ton lots (crystalline).

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Sulphate (Glauber Salt).—£5 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. Spot £4 11s. per ton d/d station in bulk. MANCHESTER: £4 12s. 6d. to £4 15s. per ton d/d station.

Sodium Sulphide. — Solid, 60/62%, spot, £20 2s. 6d. per ton, d/d, in drums; crystals, 30/32%, £13 7s. 6d. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £14 5s. to £16 10s., according to fineness.

Sulphuric Acid.—168° Tw., £6 2s. 8d. to £7 2s. 8d. per ton; 140° Tw., arsenic-free, £4 11s. per ton; 140° Tw., arsenious, £4 3s. 6d. per ton. Quotations naked at sellers' works.

Tartaric Acid.—Per cwt., for 10 cwt. or more, £15 8s.; 5 to 10 cwt., £15 9s. 6d.; 2 to 5 cwt., £15 11s.; 1 to 2 cwt., £15 13s. Less than 1 cwt., 3s. 1d. to 3s. 3d. per lb. d/d, according to quantity.

Tin Oxide.—1 cwt. lots d/d £25 10s.

Zinc Oxide.—Maximum prices per ton for 2-ton lots, d/d; white seal, £54 5s.; green seal, £53 5s.; red seal, £51 15s.

Zinc Sulphate.—Tech., £25 per ton, carriage paid.

Rubber Chemicals

Antimony Sulphide.—Golden, 1s. 8½d. to 2s. 7½d. per lb. Crimson, 2s. 7½d. to 3s. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Best white bleached, £8 3s. 6d. per ton.

Cadmium Sulphide.—6s. to 6s. 6d. per lb.

Carbon Bisulphide.—£37 to £41 per ton, according to quality, in free returnable drums.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£44 to £49 per ton, according to quantity.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 10 5/16d to 1s. 5⅜d. per lb.; dark, 10¼d. to 1s. per lb.

Lithopone.—30%, £28 2s. 6d. per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Phosphate.—Imported material, 11% nitrogen, 48% phosphoric acid, per ton in 6-ton lots, d/d farmer's nearest station, in October, £19 19s. 6d., rising by 2s. 6d. per ton per month to March, 1947.

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, in October, £9 15s. 6d., rising by 1s. 6d. per ton per month to March, 1947.

Calcium Cyanamide.—Nominal; supplies very scanty.

Concentrated Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. No. 1 grade, where available, £14 18s. 6d.

"Nitro Chalk."—£9 14s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean super-refined for 6-ton lots d/d nearest station, £17 5s. per ton; granulated, over 98%, £16 per ton.

Coal Tar Products

Benzol.—Per gal. ex works: 90's, 2s. 6d.; pure, 2s. 8½d.; nitration grade, 2s. 10½d.

Carbolic Acid.—Crystals, 11½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER: Crystals, 9½d. to 11½d. per lb., d/d; crude, 4s. 3d., naked, at works.

Creosote.—Home trade, 5½d. to 8d. per gal., according to quality, f.o.r. maker's works. MANCHESTER, 6½d. to 9½d. per gal.

Cresylic Acid.—Pale, 97%, 3s. 6d. per gal.; 99%, 4s. 2d.; 99.5/100%, 4s. 4d. American, duty free, 4s. 2d., naked at works. MANCHESTER: Pale, 99/100%, 4s. 4d. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra; higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £7 2s. 6d. to £10 per ton, according to m.p.; hot-pressed, £11 10s. to £12 10s. per ton, in bulk ex works; purified crystals, £25 15s. to £28 15s. per ton. Controlled prices.

Pitch.—Medium, soft, home trade, 75s. per ton f.o.r. suppliers' works; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER: 77s. 6d. f.o.r.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 14s. MANCHESTER: 14s. 6d. to 18s. 6d. per gal.

Toluol.—Pure, 3s. 1d. per gal.; 90's, 2s. 4d. per gal. MANCHESTER: Pure, 3s. 1d. per gal. naked.

Xylol.—For 1000-gal. lots, 3s. 3½d. to 3s. 6d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal.; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediates and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb; 66/68° C., 1s.

p-**Nitraniline.**—2s. 5d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal drums, drums extra, 1-ton lots d/d buyer's works.

Nitronaphthalene.—1s. 2d. per lb.; P.G., 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10 cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

Latest Oil Prices

LONDON.—October 23.—For the period ending Nov. 2 (December 7 for refined oils), per ton, naked, ex mill, works or refinery, and subject to additional charges according to package: LINSEED OIL, crude, £135. RAPESEED OIL, crude, £91. COTTONSEED OIL, crude, £52 2s. 6d.; washed, £55 5s.; refined edible, £57; refined deodorised, £58. COCONUT OIL, crude, £49; refined deodorised £56; refined hardened deodorised, £60. PALM KERNEL OIL, crude, £48 10s.; refined deodorised, £56; refined hardened deodorised, £60. PALM OIL (per ton c.i.f.), in returnable casks, £42 5s.; in drums on loan, £41 15s.; in bulk £40 15s. GROUNDNUT OIL, crude, £56 10s.; refined deodorised, £58; refined hardened deodorised, £62. WHALE OIL, refined hardened, 42 deg., £89; refined hardened, 46/48 deg., £90. ACID OILS: Groundnut, £40; soya, £38; coconut and palm-kernel, £43 10s. ROSIN: Wood, 32s. to 45s.; gum, 44s. to 54s. per cwt., ex store, according to grade. TURPENTINE, American, 87s. per cwt. in drums or barrels, as imported (controlled price).

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Chemical apparatus.—S. Adams. 28181.

Cyanoguanidines.—American Cyanamid Co. 27994-7.

Catalysts.—J. C. Arnold. (Standard Oil Development Co.) 28065.

Biguanide derivatives.—R. de B. Ashworth, F. H. S. Curd, J. A. Hendry, F. L. Rose, and I.C.I., Ltd. 27790.

Metal die casting.—Birmingham Aluminium Casting (1903), Co., Ltd., H. Fairbairn, and W. A. Baker. 27968.

Weed-killers—Boots Pure Drug Co., Ltd., W. Howieson, W. F. Short, and H. A. Stevenson. 28146.

Organic compounds.—British Celanese, Ltd. 28238.

Cellulose derivatives.—British Celanese, Ltd. 28476-7.

Organic nitriles.—British Resin Products, Ltd., E. M. Evans, and H. Thurston Hookway. 28116.

Methylpolysiloxanes.—British Thomson-Houston Co., Ltd. 28201.

Manufacture of salt from brine.—D. A. Crooks, T. R. Scott, and I.C.I., Ltd. 28227.

Quinoline derivatives.—F. H. S. Curd, J. K. Landquist, C. G. Raison, F. L. Rose, and I.C.I., Ltd. 27957.

Acetals.—Distillers Co., Ltd., P. L. Bramwyche, M. Mugdan, and H. M. Stanley. 28060.

Polymers.—Dominion Tar & Chemical Co., Ltd. 27893.

Polymeric materials.—E.I. Du Pont de Nemours & Co. 28229.

Butadienes.—E.I. Du Pont de Nemours & Co. 28230.

Interpolymers.—E.I. Du Pont de Nemours & Co. 28414.

Cyclohexenes.—E.I. Du Pont de Nemours & Co., and G. M. Whitman. 28228.

Filtering apparatus.—K. L. Ellila. 28472.

Dehydro-iso-androsterone.—Glidden Co. 27825.

Polyvinyl chloride sheets.—Greenwich Leathercloth Co., Ltd., and R. H. Czeczowitzka. 27898.

Aluminium alloys.—L. K. Gulton. 28459.

Aluminium compounds, etc.—E. A. E. Krause. 28455.

Thermochemical metal removal.—Linde Air Products Co. 28470.

Bonding aluminium alloys to steel.—Mallory Metallurgical Products, Ltd. 28121-2

Plastic material.—C. Nicolle. 28226.

Graphitic alloy steel.—Nitralloy Corporation. 28296.

Sodium sulphate.—P. Parrish. 28297.

Synthetic resins.—Soc. Générale des Huiles de Petrole. 28149.

Fibrous organic material.—Syntics, Ltd., and H. Hamburg. 28098.

Fumigating compositions.—J. Taylor, J. M. Holm, A. C. Hutchison, and I.C.I., Ltd. 27956.

Synthetic fibres.—Textile Machinery Corporation. 27958.

Soap products.—Thames Industries, Ltd., and A. Lewin. 27892.

Amino-ketones.—A. Wander, A.G. 28217.

Aqueous solutions.—A/B Centrallaboratorium. 28834.

Solutions of gas.—A/B Centrallaboratorium. 28835.

Acrylamide.—American Cyanamid Co. 28665.

Complete Specifications Open to Public Inspection

Monoalkamine ester-substituted pyrrole-3-carboxylic acid.—American Cyanamid Co. July 31, 1943. 12043/44.

Producing chemical compositions and products thereof.—American Cyanamid Co. March 24, 1945. 34023/45.

Organic compounds.—British Celanese, Ltd. March 20, 1945. 8342-3/46.

Manufacture of cupriferous disazo-dyestuffs.—Ciba, Ltd. March 22, 1945. 5014/46.

Manufacture of tetryl.—E.I. Du Pont de Nemours Co. Sept. 25, 1943. 9273/44.

Solutions of copolymers.—E.I. Du Pont de Nemours & Co. March 19, 1945. 8313/46.

Catalysts.—E.I. Du Pont de Nemours & Co. March 21, 1945. 8738/46.

Production of fluorohydrocarbons.—I.C.I., Ltd. March 21, 1945. 8739/46.

Deodorising seaweed and improving its flavour.—P. J. C. Margotton. March 22, 1945. 12902/46.

Producing rubber-like copolymers.—Mathieson Alkali Works. March 19, 1945. 2147/46.

Manufacture and use of resinous condensation products.—Monsanto Chemical Co. March 23, 1945. 9151/46.

Manufacture of corrosion resistant coatings for metals.—Rheem Research Products, Inc. March 21, 1945. 4565/46.

Manufacture of stabilised aqueous solutions of the alkali metal salts of 1-methyl-5-isopropyl-5-allyl-barbituric acid.—Roche Products, Ltd. March 22, 1945. 3920/46.

Production of anti-rust coatings on metals.—Soc. Continentale Parker. Oct. 23, 1940. 28303/45.

De-ironing of chromium ores.—Soc. d' Electro-Chimie, d'Electro-Métallurgie et des Aciéries Electriques d'Ugine. Dec. 13, 1943. 25118/46.

Catalytic dehydrogenation of hydrocarbons.—Standard Oil Development Co. Aug. 22, 1942. 10475/43.

Extrusion.—Aluminum Co. of America. March 31, 1945. 8478/45.

Refining method and apparatus.—Anderson, Clayton, & Co. March 27, 1945. 24562/45.

Temperature regulation of superheated vapour.—Babcock & Wilcox, Ltd. March 28, 1945. 9469/46.

Production of cellulose derivatives.—British Celanese, Ltd., March 30, 1945. 8937/46.

Production of heat sealable, transparent, cellulosic sheets and films.—British Cellophane, Ltd. March 27, 1945. 9213/45.

Organic condensation.—Dominion Tar & Chemical Co., Ltd. March 27, 1945. 25627/46.

Herbicidal compositions.—E.I. Du Pont de Nemours & Co. March 27, 1945. 25627/46.

Production of organic nitriles.—E.I. Du Pont de Nemours & Co. March 30, 1945. 9790/46.

Electro-winning of manganese.—Electro Manganese Corporation. Aug. 19, 1942. 16712/43.

Desulphurisation of vegetable foodstuffs.—J. M. L. Fabre. March 15, 1943. 25836/46.

Resin compositions and adhesives.—Firestone Tyre & Rubber Co. March 31, 1945. 9295/46.

Sedimentation device.—General American Transportation Corporation. March 26, 1945. 9088/46.

Complete Specifications Accepted

Production of thallium sulphide photoconductive cells.—J. Starkiewicz, R. L. Stow and C. S. Wright. Feb. 25, 1944. 580,550.

Tubular heat transfer apparatus, applicable to oil coolers.—Worcester Windshields & Casements, Ltd., H. Southall and T. M. Deakin. May 11, 1944. 580,652.

Tubular apparatus for cooling oil or other liquid.—Worcester Windshields & Casements, Ltd., H. Southall, and T. M. Deakin. May 11, 1944. 580,678.

Tubular heat transfer apparatus applicable to oil coolers.—Worcester Windshields & Casements, Ltd., H. Southall and T. M. Deakin. May 11, 1944. 580,679.

Refractory coating material.—H. H. York. Oct. 21, 1942. 580,541.

Nickel silicon alloy.—T. F. Bradbury. June 30, 1943. 580,686.

Manufacture of titanium pigments.—British Titan Products Co., Ltd., and R. W. Ancrum. July 27, 1943. 580,809.

Removal of stresses from thermoplastic resin articles.—C. H. Crooks, W. A. Greenwood, D. Starkie, H. Silber, and I.C.I., Ltd. Feb. 4, 1944. 580,855.

Manufacture of polyvinyl chloride.—P. W. Denny, and I.C.I., Ltd. Oct. 5, 1942. 580,731.

Manufacture of composite products of rubber and rayon and the products obtained thereby.—Dunlop Rubber Co., Ltd., and J. W. Illingworth. June 15, 1944. 580,776.

Titanium oxide pigment production.—E.I. Du Pont de Nemours & Co. Jan. 9, 1942. 580,734.

Enamel compositions suitable for application to aluminium and aluminium alloys.—E.I. Du Pont de Nemours & Co., and A. J. Deyrup. Aug. 13, 1943. 580,688.

Application of enamel compositions to aluminium base alloys.—E.I. Du Pont de Nemours & Co., A. J. Deyrup, and C. Robertson. Aug. 13, 1943. 580,689.

Manufacture of vinyl ethers.—W. J. R. Evans, and I.C.I., Ltd. Nov. 25, 1943. 580,748.

Manufacture of expanded thermoplastic materials.—Expanded Rubber Co., Ltd., and A. Cooper. Oct. 5, 1943. 580,743.

Reagent for testing for acetone.—A. Galat. July 19, 1944. 580,778.

Crystal contacts of which one element is silicon.—General Electric Co., Ltd., D. E. Jones, C. E. Ransley, J. W. Ryde, and S. V. Williams. May 6, 1942. 580,683.

Manufacture of compressed tablets and the like from finely divided ingredients.—Glaxo Laboratories, Ltd., and C. Creevy. May 11, 1944. 580,825.

Preservation of rubber or rubber-like materials.—B. F. Goodrich Co. July 15, 1942. 580,740.

Manufacture and use of plastic compositions.—W. T. Henley's Telegraph Works Co., Ltd., H. A. Tunstall, and W. F. O. Pollett. Feb. 5, 1942. 580,729.

Nitration of hexamine and hexamine dinitrate. H. R. Priston, and E. Roberts. July 15, 1940. 580,802.

Processes for thickening or solidifying liquid fuels, oils, hydrocarbons and the like and for preparing incendiary materials.—L. R. B. Shackleton. Sept. 16, 1942. 580,807.

Liquid fuel containers.—L. Shakesby, J. T. Watts, and I.C.I., Ltd. Jan. 10, 1944. 580,851.

Production of sheets and other shaped articles from disintegrated leather and/or other fibrous and/or finely divided materials and natural or synthetic rubbers.—W. F. Smith, H. Taylor, and I.C.I., Ltd. Sept. 29, 1943. 580,742.

Process for the manufacture of vat dyestuffs.—Soc. of Chemical Industry in Basle. Jan. 8, 1942. 580,681.

Catalytic conversion of hydrocarbon oils. Standard Oil Development Co. Dec. 27, 1941. 580,862.

Process for the conversion of hydrocarbon oils.—Standard Oil Development Co. Aug. 12, 1942. 580,685.

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Corrosion preventing compositions.—Standard Oil Development Co. Dec. 31, 1941. 580,845.

Method for the electrolytic preparation or concentration of heavy water.—L. Tronstad. July 27, 1944. 580,791.

Containers for liquid fuels.—J. T. Watts, L. Shakesby, and I.C.I., Ltd. March 23, 1945. 580,875.

Polarisers.—E. H. Wright. Feb. 28, 1945. 580,869.

Materials for producing plane-polarised light.—E. H. Wright. July 13, 1944. 580,870.

Manufacture of polystyrene.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. Nov. 3, 1944. 580,911.

Manufacture of interpolymers of styrene with polyhydric alcoholic mixed esters and of coating compositions obtained therefrom.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and F. Armitage. Nov. 3, 1944. (Addition to 573,809.) 580,912.

Manufacture of interpolymers of styrene with frosting drying oils and of coating compositions obtained therefrom.—L. Berger & Sons, Ltd., L. E. Wakeford, D. H. Hewitt, and R. R. Davidson. Nov. 3, 1944. 580,913.

Bleaching organic acid esters of cellulose.—British Celanese, Ltd. July 27, 1943. 581,046.

Titanium dioxide pigments.—British Titan Products Co., Ltd., and R. W. Ancrum. Oct. 26, 1943. 581,008.

Heat treatment of metal plates.—Budd Induction Heating, Inc. Nov. 8, 1941. 580,976.

Centrifugal dust separating and collecting apparatus.—Buell Combustion Co., Ltd., and G. B. Tyler. July 28, 1944. 580,936.

Treatment of water.—Burgess Zeolite Co., Ltd. Sept. 21, 1942. 580,966.

Luminescent powders and methods of manufacturing such powders.—Cinema Television, Ltd., K. A. R. Samson, and R. B. Head. June 15, 1944. 581,030.

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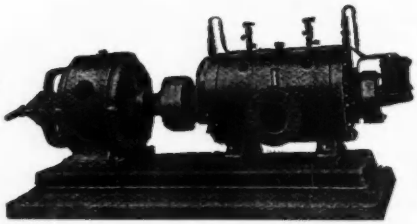

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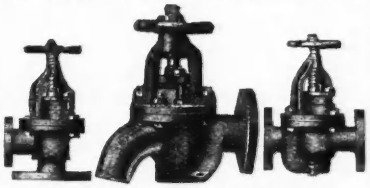

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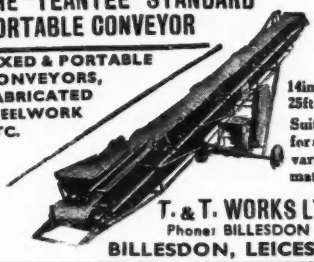

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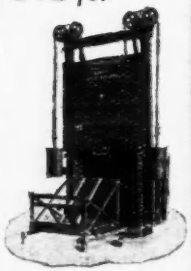
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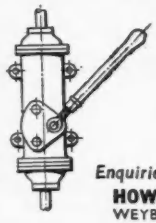
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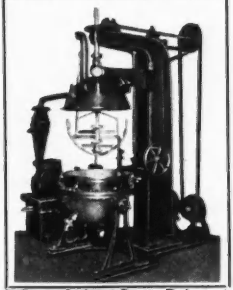

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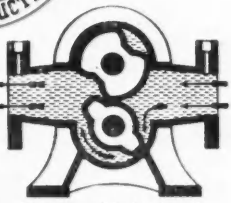

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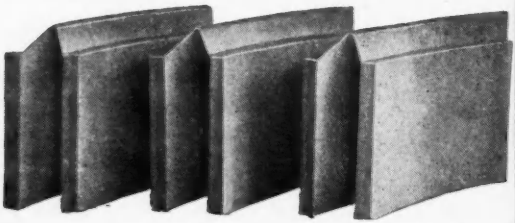

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